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Illustrated.

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The Steel Investigation

The congressional investigation of the steel trade and especially of the Steel Corporation, has attracted attention on account of the prominent men who have been on the stand as witnesses. Attempts have been made in some quarters to make a sensation out of some statements brought out, but they are not at all warranted. The fact is that on the two points chiefly dwelt on by the committee—the organization of the Steel Corporation and its purchase of the Tennessee Coal, Iron and Railroad Company in 1907—the witnesses told nothing that was new to people interested in the steel trade; or indeed to anyone who has been a reader of the current news. There are, however, two points which are of interest in some degree.

One of these is of general rather than special interest, and that is the different views of the same transaction that may be taken by two men, both of them thoroughly familiar with the facts. Sifted down to their ultimate statements, Judge Gary and Mr. Gates did not materially differ as to the Tennessee purchase; and yet on the surface their accounts were widely different. The variations only illustrated differences in temperament and point of view.

The other matter of interest is the waste of time and effort which is, unfortunately, involved in too many Government transactions. It appears from Judge Gary's statement that the Bureau of Corporations has been engaged for several years in the investigation of Steel Corporation affairs. This has involved much labor and expense, both to the bureau and the corporation. The information gathered has been presumably just what the committee wants; and yet it was not at the committee's disposal, nor, indeed, were the members aware of its existence until they were told of it by the witness. They were going all through the slow and costly process of gathering over again the evidence which should have been under their hands.

In justice to the Steel Corporation it must be said that no other prominent corporation has been so open and full in its published reports. Its policy from the first has been to give full publicity to its operations to a degree which it would be well for others to imitate. We are gradually getting toward that point, either by law or by the pressure of public opinion, but progress seems slow.

It does not appear likely that the investigating committee will bring out much that is new or of great importance. This is largely for the reason that most of the facts are already public property, as we have said above; partly also because the members of the committee are not experts. One point which the committee has not touched, and apparently has not had in mind at all, is the Steel Corporation's control of iron-ore reserves, which it has extended at every opportunity. In part, of course, this is a prudent care for future needs; but it has also the collateral effect of making more difficult each year the organization of any effective competitor on a large scale—which might be a subject for congressional thought.

Mine Accidents

The report of the Committee on the Prevention of Mine Accidents was under discussion of the San Francisco section of the Mining and Metallurgical Society at its last meeting. In this, as in previous discussions by other sections of the Society, the idea on the part of some mine managers that they do not want any State inspection found expression. This is not unnatural. It is human to balk at first at the proposal of anything new, chiefly because it promises to disturb existing customs and ingrained habits. Moreover, the experience with public officialism in many parts of the United States, especially when characterized by incompetency, tends to produce a fear of any advanced State regulation.

It seems to us, however, that objections upon this ground to the recommen-

dations of the Committee are based upon a misconstruction of its report. In fact the Committee did not contemplate the regulation of safety in mining by the class of State inspectors now in office, although we have no doubt that the Committee would recognize that there are many intelligent, earnest and competent men in such positions.

The Committee was emphatic in its recommendation that the States should individually appropriate a great deal more money for mine inspection than is done at present by any one of them, and should provide for a superior class of inspectors. In this the Committee aimed evidently to be educational, seeking to show to State legislatures what sort of thing they ought to do if they are desirous of reducing the excessively high loss of life that now disgraces our mining industry.

The Committee furthermore presented a draft for a uniform law to be taken as a model, its presentation being, however, tentative. It was recognized that it was extremely difficult to frame such a law whereof all of the specific provisions would be applicable to the widely diverse conditions of mining in this great country without working undue hardship in some districts. Consequently the tentative draft was laid before the three national mining societies of the country for criticism that would develop its weaknesses from the point of view of operators in many districts. This discussion has accomplished precisely what was desired by the Committee, which is now in a position to frame an amended draft, and we understand that to be its intention.

Without going into the discussion of details, we will refer briefly to some broad criticisms expressed during the debate. Much of this evidently ignored the statement of the Committee, besides the intrinsic evidence, that its draft had been framed with legal assistance and within constitutional limits, the latter being barriers that could not easily be jumped. Thus it has been said that the specifications are too minute and calculated to harass the average operator. That is precisely what they would not do.

It would, perhaps, be possible to frame a constitutional law of broad outlines, authorizing the inspector to check all dangerous practices under the police power, the citizens having to go to the courts to secure their rights in the event of malfeasance on the part of the inspector, bad judgment, etc., but we are quite sure that mine operators would not stand for anything of that kind.

The other alternative, as adopted by the Committee, is to state in the law specifically what may and may not be done, and make it the duty of the inspector to see that the law be obeyed without any option on his part. Such a law can not leave matters to the judgment of the inspectors in any way that would be a delegation of the legislature's power to legislate. In fact the draft of the Committee is no more cumbersome than the existing laws of the more enlightened States, upon which it is, indeed, based to a very large extent.

There is, however, the difference that many of the provisions of existing laws are not enforced, while those drafted by the Committee are intended to be enforced, and means for their enforcement are specified. But this enforcement is contemplated under a greatly improved system of mine inspection, not under the present one. This is really something that ought to be welcomed by all mining operators, who ought to do everything in their power to bring it about.

However, we do not suppose that the Committee is so utopian as to expect the immediate adoption of its proposals in any State. In all probability the first adoption will be by individual mining companies, especially the larger and more enlightened concerns, who will introduce all the rules of safe practice, applicable to their own cases, out of self-interest, if for nothing else. Indeed many of the leading mining companies are already doing substantially all of that, and we have no doubt that an examination of their records would show a lower rate of fatality than the average. It is not the large operators so much as the medium and small who need regulation. But by all of them an advanced, but at the same time conservative, system of inspection ought not only to be invited, but also to be urged. In the march of our times the alternative will probably be drastic employers'-liability measures, which may make a thorough-going inspection law tame by comparison.

Equalizing Coke Rates

Rate decisions of the Interstate Commerce Commission do not always work out as the applicants for revision want them. Some time ago certain users of coke in the Chicago district brought a charge of discrimination against the railroads hauling Connellsville coke because they maintained two rates—one of $2.35 per ton on blast-furnace coke and one of $2.65 on coke for other uses. The commission approved the complaint and ordered that rates should be equalized. The railroads have complied by giving an equal rate of $2.50 on all coke. Now both parties are disgruntled; the foundry people because they did not get the $2.35 rate they wanted, and the blast-furnace people because of the 15c. advance. But the railroads are satisfied.

We have received a letter from Arizona, stating that a young man recently called at a certain mine and stated that he was a regular correspondent for the ENGINEERING AND MINING JOURNAL. He asked permission to examine the mine, and being regarded as a representative of the JOURNAL, all courtesies were extended to him. Our correspondent continued as follows: "Subsequently, we came into possession of certain information that leads us to believe that we were imposed upon by this young man, and that he came here for an entirely different purpose." The supposition of our correspondent is the fact. He was imposed upon. The man in question was not only no correspondent of the JOURNAL, but also we never previously had heard of him. Correspondents of the JOURNAL are invariably provided with credentials, which they are glad to exhibit when requested. Our readers will please take note of this.

The average price of electrolytic copper in New York for the month of May was 11.99c. To parallel this price it is necessary to go back nine years, for in no year since 1902 has the average for any month fallen so low. In 1902 the quotation was under 12c. for 10 months of the year and the average for the year was only 11.626c.; the lowest point being in January, when 11.053c. was reached. To go below that point it is necessary to go back nine years further, to 1893, when Lake copper sold at 9.75c.; electrolytic averages were not then recorded.

Correspondence and Discussion

Notes on Mine Sampling

In the JOURNAL of March 4, Glenn Anderson has contributed an instructive article, entitled "Notes on Mine Sampling," in which, however, occurs an obvious slip, to which attention should be drawn. The slip occurs in the averaging of the sampled widths shown in his form of "Sample Record." The relevant figures are:

Sample		Width in Feet
1	200 L. at Sta. 1 50	6
2	200 L. at Sta. 1 55	5
3*a*	200 L. at Sta. 1 60	1
3*b*	200 L. at Sta. 1 60	4
3*c*	200 L. at Sta. 1 60	2
4	Raise 10, 10 ft. above level	4

By adding up the column of feet, and dividing the total by 6—the number of samples for assay—Mr. Anderson arrives at an average width of 3.67 ft. for the whole. Opinion will differ as to whether the raise sample should be included with the levels, when the sampling interval is different, and less ore exposure is covered. But let that pass. Mr. Anderson's slip lies in the fact, that he has calculated samples 3*a*, 3*b*, 3*c*, as though they represented three different intervals, when in fact, they are components of one. Therefore the average of his figures should appear thus:

Sample No.		Width in Feet
1		6
2		5
3*a*	1 ft.	
3*b*	4 ft.	7
3*c*	2 ft	
4		4

Number of sampled intervals, 4; sum of total widths, 22 feet

The average width of the samples, is therefore $22 \div 4 = 5.5$ ft., and not 3.67 ft. as given by Mr. Anderson, or an excess which would represent approximately 50 per cent. increase in tonnage, if the figures applied to a block of ore.

G. A. DENNY.

Mexico, D. F., May 27, 1911.

Removable Converter Tuyeres

I have read with interest Carr B. Neel's articles on basic converting. In the article in the JOURNAL of May 13, mention is made of removable pipe-tuyeres, which are designed to be removed when they become accidentally filled with copper or matte. It is also stated that this invention was simultaneously worked out at rival plants.

In this connection I wish to refer to U. S. patent 593,447, Nov. 9, 1897. A careful study of the description of this patent will show that the inventors in the two rival plants must have kept their eyes closed in regard to preceding patents, otherwise it is easy to see how they happened to be worked out independently.

With all due credit to others, I claim that the inventor who took out the above patent was the originator of the idea of a tuyere designed to be removed when filled with molten material and to be replaced by the same movable part, or by a new part, to avoid the expense of drilling the plugged tuyere.

J. L. WELLS.

Lordsburg, N. M., May 22, 1911.

Views, Suggestions and Experiences of Readers

Management of the Inefficient

In the JOURNAL of June 3, Evan Fraser-Campbell, in his article on the management of Mexican labor, strikes the keynote of successful management of indolent natives in saying, "The successful manager is the one who understands the limitations of the people and is willing to adapt his methods to their capabilities." Everyone who has had a long experience in the tropical Americas knows how rarely a mine manager, new to such countries, ever realizes this fact and how long and often how costly to his company is the learning of the lesson of treating the natives with patience and tact.

From my own experiences in Mexico and Central America I am inclined to think that the natives of the smaller republics, especially the inhabitants of the higher plateaus and mountainous regions, are more ambitious and can be made more efficient than the Mexicans. It seems possible to more easily awaken in them a desire for some of what they would call the conveniences of life and which we would think of as absolute necessities.

Mexican laborers as a rule are too easily satisfied and are content with enough food for the day and enough *aguardiente* for their immediate needs. The Central American natives are as content with their lot as the Mexicans but, especially in the more remote regions, if they are shown some of the conveniences that money can buy, they will go to work earnestly and on pay day will spend most of their wages for cheap clothes for themselves and families and but comparatively little, except at feast days, for *guarro*.

The Central American native has cleanly tendencies and nothing suits his fancy better than bathing each night after work and dressing in clean clothes. Especially on Sundays do they choose to array themselves in all their glory, and with their women folk in stiffly starched spotless wash-goods dresses they have no desire to hide their lights under a *zerape*. It is by taking advantage of such idiosyncrasies that the tactful manager can secure an abundant labor supply, develop fairly good workmen and keep his laborers from deserting to another employer. I always planned to have the small merchants of the nearby towns visit the mines with a muleload of goods upon pay days; the company was not interested in the transactions as there was a more substantial gain in permitting free trade with the laborers' own people that did much to establish a pleasant but respectful *entente*, and more than all else quickly depleted "booze reserves."

In one remote, mountainous region the natives all owned their houses and a small plot of land which they cultivated for two crops of corn each year. For many years they had had no opportunity to earn wages; they were contented with their lot; looked with suspicion on the *gringo* and but few could be induced to go to work. A few of the men had mules and provisions to sell to the mine; then one day there came a merchant with a large stock of attractive cheap goods. Those who had worked or sold provisions had money to make purchases; that made their neighbors envious; they also wanted to work then, and after six weeks there was working a force of 150 men at the mines, where, before, attempts to secure workmen had been given up in disgust by some strangers to the manners and usages of the country.

In this particular region the natives understood but one way of working for a man and that was under a system of patronage. After the confidence of the natives had been acquired they considered the manager as their *patron* and felt inclined to do as he dictated; they also felt that all personal squabbles should be settled by him, which was often a nuisance, but laborers were scarce and such treatment only would have held the men at work. They received on the average 23c. per day, out of which they fed and clothed themselves and families.

At another place where labor was scarce and the natives were disinclined to work, it was the custom of the government to conscript every male over 16 years of age for so called military service. The manager took advantage of

this in securing a labor supply that never failed him. He secured 300 exemption certificates from the government, one of which he made out in the name of each man he wished to employ, provided with which the *escoltes* would not molest a mine employee. This act of diplomacy gave the manager power to send a man to work or choose the alternative of becoming a soldier.

These remarks do not show that a high efficiency was developed in the miners; they are given to convey an idea of the advantages of learning the "customs of the country" and of the difficulties of securing laborers in certain regions. Many of the men did develop into satisfactory miners and made excellent records of cheap and rapid work that have not since been broken.

The contract system always proved most efficacious and often the men would rise at daylight to complete their tasks by noon. This was permitted and encouraged for all classes of work where possible, and in other work where shifts were necessary it was found better and cheaper to work the men hard for short shifts. They did not have the stamina to work long hours.

J. A. HERDY.

New York, N. Y., June 5, 1911.

Geology Applied to Mining

As stated by Linforth and Milburn in their article in the JOURNAL of April 1 there is no question but that "the success and real value of a geological department depends on the proper relation of theory to practice;" but to say that a well conducted department will pay more attention to some structural features of the geology in the mine workings than to the distribution of the minerals in the ore is to make a dangerous generalization which may not always be true.

The work of a geological department is of value to a company in direct proportion to the increased dividends which it enables the company to pay, whether this be accomplished by the intelligent use of some models in reducing mining costs or by the examination of a few thin sections resulting in the discovery of a new orebody. The Butte district is a case where the accurate recording of what might be called the geometric features of the orebodies on plans and sections is the most important feature. I recently had occasion to see a property where the ore occurred in sheets, horizontal or inclined at a low angle in a sandstone-shale series and where plan and sections of mine workings and the surface geology of the immediate vicinity gave few clues to the fact that all the important orebodies were localized in three or four out of a dozen or more very similar members of the series. This point, essential to intelligent prospecting and development by drilling, appeared only on a detailed examination of an area several miles square.

In other cases it may be microscopic work which indicates the definite relation of an orebody to an igneous intrusion when subsequent metamorphism has so altered all the rocks as to make their recognition impossible megascopically. Or a careful study of analyses of various gossans and the minerals in the unoxidized ore may show some small difference which will give a clue to the type of ore from which gossan was derived, by which drilling can then be successfully directed. In developing new properties the distribution of the minerals in an ore as well as the other chemical and physical features may be of the utmost importance either to the metallurgist in determining the cause of his troubles or to the mine manager or both in considering the probable changes in the ore at greater depth.

The proper duties of a geological department vary widely according to the conditions. Of course, the first task that usually falls to the geologist, particularly if a property has been worked some years and has changed hands frequently, is the assembling of a vast number of more or less useful maps and fragments of maps of surface and underground workings, boreholes, trenches, etc., in fact all the data at hand including what may be gleaned from the literature on the region, into one series of maps which represents all the accurate information to be had, and which is then kept up to date regularly. Results of assays and other analytical data that can not be shown quantitatively on the maps should be gathered together is as compact a form as possible, well indexed, and mineralogical and petrographic specimens numbered and catalogued and all data in connection with them kept systematically.

If the structural geology is complicated models are useful. When prospecting is done partly by core drilling the statistical part of the work should be under the geological department, viz., the filing of cores, keeping of the records, results of analysis, etc., the interpretation of results and placing of new holes; the mine manager or his assistants remaining responsible for the operation of the drills. All other prospecting and exploration work also naturally comes under the direction of the geological department.

Finally in a large company the consulting geologist or the geologist in charge may be a useful assistant to the managing director or consulting engineer in the examination of neighboring prospects or mines with a view to optioning or purchasing for the company, since in the estimation of ore in sight, probable and possible ore, geological training and experience are of great value.

C. T. BRODRICK.

Kyshtim Mining Works, Russia, May 13, 1911.

Sampling Ores from Cobalt Mines

In the article by F. W. Pugsley on sampling Cobalt ores, in the JOURNAL of April 15, the point is made that ordinarily there is a segregation during sampling owing to the coarse particles rolling down the ridge and the fine staying on top, and that this is obviated by sprinkling the ore. In the ridge method of mixing there is another danger arising from the same causes, which Mr. Pugsley does not mention.

This is, that in making the ridges, if the ore is thrown from the old ridge to the new, the coarse will carry farther, and the far side of the new ridge will be coarser than the near. This tendency is not overcome by moistening. If the men carry the ore carefully from the old ridge to the new, to avoid this segregation, labor costs run up tremendously. From my own experience I would think that the hand sampler was, under the best conditions, simply making the most of antiquated methods, and that machine sampling with Brunton samplers and Jones riffles would be quicker, cheaper and more accurate. A. A. NASON.

New York, May 17, 1911.

The Standard Oil Decision

In the editorial on the Standard Oil decision in the JOURNAL of May 20, passing reference was made to the effect of the decision on the copper-producing companies. Sentiment in the Lake Superior district has changed perceptibly and a more hopeful attitude is everywhere apparent, although conditions as regards the copper-metal market have not improved over those of a month ago. This change of sentiment is directly attributable to the decision.

The majority of the properties in the Lake district, at the present time more than ever before, are doing their utmost to shade the cost of production so as to permit a profit at the prevailing price of copper, and to assure a small dividend. It is only by the most strenuous efforts that a number of these have succeeded in conducting operations up to the present.

L. E. CANBY.

Hancock, Mich., June 2, 1911.

Cost of Channeling

In the JOURNAL of May 27, page 1043, there is a short paragraph regarding the excavation of the site for the new Grand Central terminal in New York. We wish to call attention to an error in the cost of channeling which is reported as 75c. per sq.ft. This was the cost of drilling and broaching and was evidently mistaken for the cost of channeling, which was but 40c. per square foot

SULLIVAN MACHINERY COMPANY.

New York, May 31, 1911.

Amalgamated Copper

In the report of the Amalgamated Copper Company for the fiscal year ended April 30, 1911, it is stated that all of the subsidiary companies to which the Anaconda Copper Mining Company offered its stock in exchange for properties, have completed the transfer, several have gone out of existence and others are in process of dissolution.

The Anaconda company offered the Amalgamated in payment for the properties transferred to it by the Original Consolidated Mining Company, the Clark Montana Realty Company and the Colusa-Parrot Mining and Smelting Company, 112,500 shares of its stock, and this offer was accepted. The stock has been set aside, but not delivered, waiting for certain details of transfer to be completed.

As the contracts for the sale of metals produced by the companies controlled by the Amalgamated were about to expire, and as these companies had transferred to the Anaconda company all of their properties and assets, Amalgamated's directors decided that the selling organization and the refining of the bullion produced by that company should be controlled and managed by the Amalgamated.

The United Metals Selling Company had sold for about 10 years the metal product of the mines, acting as agent for all of the companies in which the Amalgamated had substantial interests, as well as for a number of other producing companies. That company also owned 40 per cent. of the stock of the International Smelting and Refining Company, which owns the refineries at which most of the metals produced by these companies are refined.

In order to take advantage of the efficient and established organization of the selling company and to own a large interest in the refining profits, it was decided to buy the stock of the United Metals Selling Company, if it could be acquired at a satisfactory price. After prolonged negotiations a price of $241 per share, or $12,050,000 for the total capital stock, after deducting dividend then declared, was agreed upon, and that price was paid for all stock offered. Nearly all of the outstanding stock has been purchased. To provide funds for this purchase the Amalgamated company issued $12,500,000, 5 per cent., two-year notes, dated April 1, 1911. In addition to the $4,000,000 stock of the International Smelting and Refining Company at par, the United Metals Selling Company had in cash and cash assets, chiefly accounts receivable, an amount that gave it a book value of about $11,000,000, or $220 per share. Allowing a value below its market price for the stock of the International company, and crediting earnings on unexpired contracts for the sale of metals, the actual value of the United Metals stock is stated to have been fully equal to the price paid for it, and no allowance was made for good will or the going business, excepting the unexpired contracts mentioned.

At the time of the purchase of the Metals Selling stock, a long-time contract for refining, to go into effect in September, 1911, was entered into between the Anaconda and the International Smelting company, which insures a large decrease in that item of cost of product.

Since the increase in 1901 in the capital stock of the Amalgamated company from its original issue of $75,000,000 to its present amount, in order to acquire the stocks of the Boston & Montana Consolidated Copper and Silver Mining Company and the Butte & Boston Consolidated Mining Company, no securities of any kind have been issued to provide additional money, with the exception of notes for $5,000,000 given to W. A. Clark on June 1, 1910, in payment for the mining properties transferred to the Anaconda Copper Mining Company, and the $12,500,000 in two-year 5-per cent. notes, issued April 1, 1911, to provide means for paying for the stock of the United Metals Selling Company.

Since the organization of the Amalgamated company there has been charged off against earnings and surplus by the subsidiary companies which are now in the Anaconda Copper Mining Company: For depreciation and dismantlement, $30,141,357; for depletion of coal mines, $614,343; for depletion of timber lands, $654,356; total, $31,410,056. The plants and equipment of the properties of the subsidiary companies have been maintained to the point of full efficiency, regardless of expenditure, and that policy has been pursued rigidly since the company's organization.

Alaska Coal Lands

WASHINGTON CORRESPONDENCE

A number of business men from the northwestern States are at Washington to urge upon President Taft the necessity for some immediate action that will place Alaskan coal lands in a position to be exploited. Among the organizations represented were: The Seattle Chamber of Commerce, the Seattle Commercial Club, the Seattle Rotary Club, the Seattle Arctic Club, and the Alaskan Committee of the American Mining Congress. The wrongs they complain of are:

That prior to Nov. 12, 1906, more than 900 citizens had made locations of coal lands in Alaska not exceeding 160 acres each and applied to purchase the lands at the price fixed by the law; that these locations had been pending from five to seven years and not one had been passed upon, either favorably or unfavorably, by the proper authorities. The Government, while accepting and retaining the purchase price of the lands in question and giving receipts therefor, had refused, and still refuses, to give a decision either for or against the claimants in question. Continued delays on the part of the Government in bringing these matters to a decision have been productive of irreparable injury and loss to the development of Alaska at large and the *bona fide* claimants against many of whom no question of fraud or violation of law has ever been charged.

That the order of Nov. 12, 1906, suspending the law relating to the entry and sale of coal lands in Alaska was without authority of law.

That the order of July 1, 1910, wherein it was attempted to ratify the former order of Nov. 12, 1906, is probably open to the same interpretation that it was equally without authority of law, and that the locking up of the coal lands was done by these orders without legislative sanction.

That no complaint is made in regard to the laws as they stand on the statute books, but complaint is made of the failure of the properly constituted executive officers to enforce them.

Calumet & Hecla Merger

HANCOCK CORRESPONDENCE

The hearing in the Denton-Chadbourne injunction suits, asking a temporary injunction restraining the Calumet & Hecla from merging with the Ahmeek, was started June 1 in the Houghton County circuit court, Judge A. T. Streeter presiding. Numerous affidavits were read, a strong point of contention being the value of the Calumet & Hecla conglomerate sands, the tailings of the stamp mills at Lake Linden. The affidavits of C. H. Benedict, metallurgist for the Calumet & Hecla, stated that these sands amounted to 37,000,000 tons, and averaged 15.43 lb. of copper to the ton, as proved by numerous and regular assays. The present regrinding plant, with a capacity of 1500 tons daily, turned out, during 1910, over 2,000,000 lb. of refined copper at a cost of less than 5c. per lb. Affidavits from W. J. Uren, formerly superintendent of the Bigelow group of mines, J. W. Shields, mill superintendent of the Quincy, and F. W. Denton, general manager of the Copper Range Consolidated, were read, tending to show that the value placed upon these sands was too high.

Judge Streeter announced his decision June 5 denying the injunction and dissolving the restraining order issued to Chadbourne and Denton to prevent the completion of the Calumet & Hecla consolidation plans. By stipulation of attorneys it is agreed that the meeting of the stockholders of the Laurium Mining Company should be adjourned from June 7 to June 21 to admit of any action

that might be taken by the Supreme Court in the meantime. There are two other restraining orders outstanding against the consolidation at Detroit and at Lansing, in which decisions have not yet been announced; but the petition just denied was more complete, covering every contention, and its rejection is regarded by Calumet & Hecla officials as particularly significant.

Cuyuna Range Development

SPECIAL CORRESPONDENCE

One of the most important events, in many ways, that has taken place in the development of the Cuyuna iron range, has recently occurred in the actual commencement of mining operations by the M. A. Hanna Company, four miles southwest of Brainerd, in T 44 R 31. The land embraced in the Barrows property is owned by the Brainerd Mining Company and is under lease to the Hanna company.

The present plans are to sink a timbered shaft. This work is important because the property is avowedly situated on the so called South range, and while the South range has been drilled in many places and commercial ore found, at only one other place has mining work ever been actually attempted, and that in a rather desultory manner. When the range was first being explored, the Pickands-Mather company sunk a shaft in the southwest corner of Sec. 8 T 45-R 29, a few miles south of Deerwood. This shaft was about 100 ft. deep, and at that depth a crosscut was driven 150 feet.

A fair tonnage of ore, running about 50 per cent. in iron, was indicated, but no further work was done. Beyond this all actual mining work has been confined to the North Range bodies, and with apparently considerable reason. It has been generally understood that the South Range ores are of a different character from those found to the north, and that the deposits themselves are narrower and extend to a shallower depth. This conclusion has been deduced from actual mining operations on the North range and countless drill records on both the North and South ranges, but with the exception of the instance above cited, has never been proved by mining work on the South range.

Miami-Inspiration

Negotiations looking toward an amalgamation of the Miami and Inspiration companies have been in progress during the last fortnight, but the projected plan has now been abandoned, owing to inability of the two parties to agree upon mutually satisfactory terms.

The Standard Mine, Silverton, B. C.

BY JOHN VALLANCE*

The Standard mine has attracted much notice of late, owing to the opening of large shoots of galena ore of good grade. The group includes 13 mineral claims. The mine is at an altitude of 3354 ft. above sea level and 1594 ft. above Silverton, on the eastern shore of Slocan lake, 1½ miles distant from the mine. Development work on a systematic plan has been in practically continuous progress since 1904. The "big oreshoot" was cut by the lower levels in 1909-10, and the present remarkable showings of ore exposed.

The inclosing country consists of old, very silicious sedimentary rocks, cut in places by masses and dikes of an eruptive rock generally classed as granodiorite. A large "boss" of this rock occurs along the east side of the Standard claim and is, apparently, the center from which the local dikes radiate. The sedimentary strata are mainly hard, blocky argillites, silicious shales and impure quartzites. The Standard vein is a strong fissure cutting the bedding planes of the inclosing sedimentary rocks; a dike of quartz-diorite-porphyry is intruded into the fissure and lies along the footwall side. This dike rock is much altered and appears to be, in some manner, closely connected with the principal orebodies; probably the clayey-talcose matter of the altered dike has influenced the course of the mineral-bearing solutions and caused the ore to be deposited on or near the dike, where it is most frequently found. Much evidence of large and repeated movements is found in the vein, especially toward the hanging-wall side, and at some points movements have occurred after the formation of the orebodies—masses of galena being found deeply striated by movement of adjoining hard gangue material.

The principal minerals are argentiferous galena and blende, with some pyrite, chalcopyrite and gray copper (freibergite) as associated minerals. The freibergite occurs as specks and bunches mixed with the galena, but occasionally with the blende, and it is evidently highly argentiferous, for specimens have assayed as high as 2000 oz. silver per ton. The gangue is quartz, calcspar and spathic iron, with inclosed fragments of shale and occasional masses of altered dike rock.

In the workings above the fourth level, the orebodies found were lenticular in form and following a zone pitching about 30 deg. From No. 4 down to No. 5 level the "big shoot" of galena has a pitch of nearly 28 deg. Where the shoot is cut by No. 5 level the vein gradually widens from 4 to 30 ft. Here the clean galena has its maximum width of 15 ft., the remaining 15 ft. being high-grade milling ore with included masses of clean galena. From here to the present face of No. 5, which is approximately 1200 ft. from the portal of the adit, the vein widens and the orebody gradually changes its character, the shoot of clean ore giving place to a great mass of milling ore inclosing irregular bodies of solid galena. The ore shoot has been opened a length of 250 ft.; a crosscut at the present face shows ore, chiefly milling grade, about 85 ft. in width.

The mine workings consist of six levels, with connecting raises from No. 5 upward, and a number of crosscuts from the levels, where the vein is wide. Not including stopes and crosscuts, the mine openings have, together, a length of 8500 ft. The depth on the vein, from No. 1 to No. 6 level, is 740 ft. After connection shall be made with No. 5 by raise, No. 6 will become the main adit for the mine, and the upper terminal of the aërial tramway will be placed at its portal.

Ore from stopes above No. 4 level was taken out by ordinary overhand method, and the ground timbered with a two-piece set, or by stulls, as required. In the lower levels, where the vein is wider, the large orebody will be extracted by overhand stopes with square-set timbering. Ore extracted has been roughly graded in the workings; the cleaner ore has been sent to the sorting houses, while the cobbings from this and all second-grade ore from the mine, have been placed on the milling-ore dumps. Shipments to the smeltery to date aggregate 4418 tons; average metal contents were: Silver, 78.46 oz. per ton; lead, 62.5 per cent.; zinc, 5.88 per cent. Some shipments returned more than 100 oz. silver per ton, and others 73 per cent. lead. In addition to large orebodies blocked out in the mine, there is much ore in the sorting houses ready for shipment when the aërial tramway shall be completed; the milling dump is estimated at 8000 tons, which will concentrate 3½ or 4 tons into one ton of shipping product.

Preparatory to mining on a larger scale than in the past and commencing milling operations, a 10-drill compressor plant and a concentrating mill with a grinding capacity of 200 tons and dressing facilities for 100 tons per diem are being put in. Water power will be utilized, with a head of 160 ft. at the compressor and 275 ft. at the mill. The Leschen aërial tramway will be 7600 ft. in length, with a grade of 16 per cent., and a carrying capacity of 20 tons per hour. The tramway and compressor should be in operation in July and the mill should be ready in October.

NOTE—Abstract of paper read before Western Branch of Canadian Mining Institute, May 18, 1911.

*Mining engineer, Silverton, B. C.

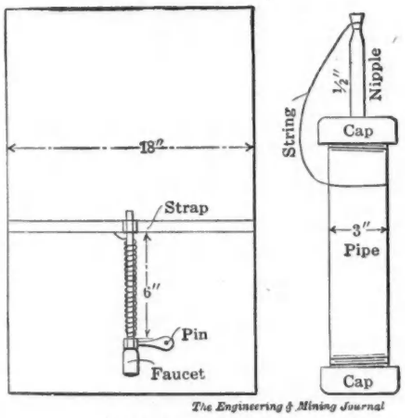
Details of Practical Mining

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent of telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining

Saving Oil in Mines

Much oil is wasted at mines through the carelessness of the machine men in closing the oil-can valve after getting oil. This waste can easily be done away with by placing spring valves on the oil cans which close as soon as the man takes his hand off. An accompanying illustration shows the Tonopah Mining Company's manner of applying the spring to oil cans which are equipped with a rotating valve. An ordinary iron strap is used to furnish the seat for a spindle, which terminates in a yoke fastened over the valve of the can, and this strap iron fastens the whole to the body of the can. Around the spindle, which is about six inches long, is twisted a spiral spring, which at its upper end is secured to the strap iron and at the lower end to the spindle so as to close the valve. In order to prevent the valve from being rotated too far a pin that strikes upon the body of the can is riveted to the handle.



OIL-SAVING DEVICES

Another source of waste of oil is the use by the machine runners of old tin cans or bottles to hold oil. A tin can is not good as it allows dirt and grit to get into the oil, while a bottle is easily broken. If regular oil cans are supplied, the men lose them either by forgetting them at the face when they blast, or else by dropping them out of their pockets while climbing around in the stopes, and much friction results if the company tries to make the miners pay for these lost cans. Consequently, it is often better to provide the men with homemade oil cans. These can be made cheaply by using short pieces of gas pipe with a cap to form the bottom of the can, a reducer to form the neck and a short nipple, swaged down to a small opening, for the throat. A piece of wood whittled down to enter the hole in the end of nipple forms the stopper which is fastened to the oil can by a string to prevent loss. The accompanying illustration shows the idea which is in use at many mines in preference to the more expensive purchased can. The advantage of these cans is that they are so clumsy that they cannot easily be lost, and no one will steal them.

The Calumet & Hecla has begun the manufacture of stamp shoes in its foundry. A limited number have been turned out and they have given good results both in life and uniformity of wear. Casting machines are to be installed and these shoes are to be a regular product.

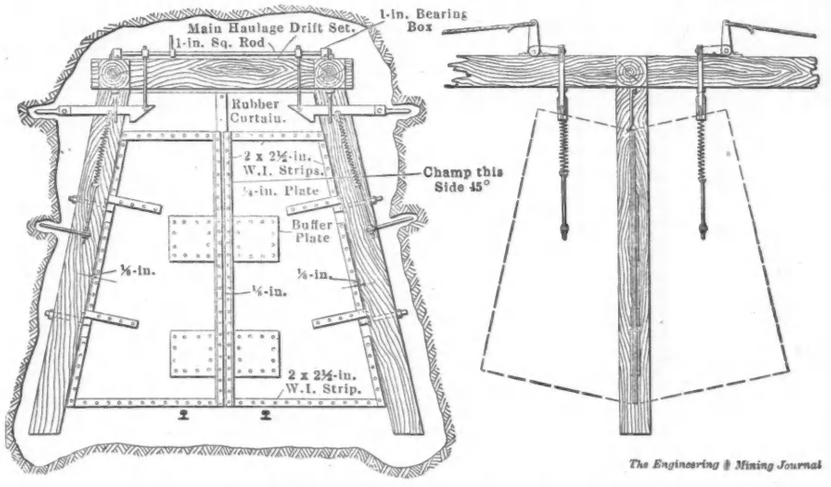
Determination of Gas Velocity in Flues

A method of approximating gas velocity in flues is by means of nitric acid poured on copper filings. Perform the experiment of putting the acid on the copper filings several times in air, noting the interval which is required before a visible cloud of the peroxide fumes forms. Then introduce an evaporating dish or similar container of copper filings into the flue or chimney, and arrange a funnel or other delivery tube to convey the acid. Pour on the acid and with a stop watch observe the elapsed period before the fumes appear at the end of the flue. Subtract from this the correction noted before for the time required to generate the fumes, and divide the distance by the result.

A Mine Air Door

BY P. L. WOODMAN*

The accompanying sketch shows the details of a mine air-door and of an opening and closing device used in the motor-haulage drifts of the Copper Queen mine. The doors are opened and closed without stopping the train.



DETAILS OF MINE AIR-DOOR AND CATCHES

When a train approaches, the motor or end car pushes the doors which are free to swing in either direction; upon opening, they are caught and held by the latches set in both walls and on each side of the door set. The releasing lever is operated by a cord a hundred feet or more in length conveniently hung at the roof of the drift. The motorman simply pulls the cord in passing and the levers release the doors allowing them to swing shut.

*Mine superintendent, Copper Queen Consolidated Mining Company, Bisbee, Ariz.

A Timber Headframe

By H. L. Botsford*

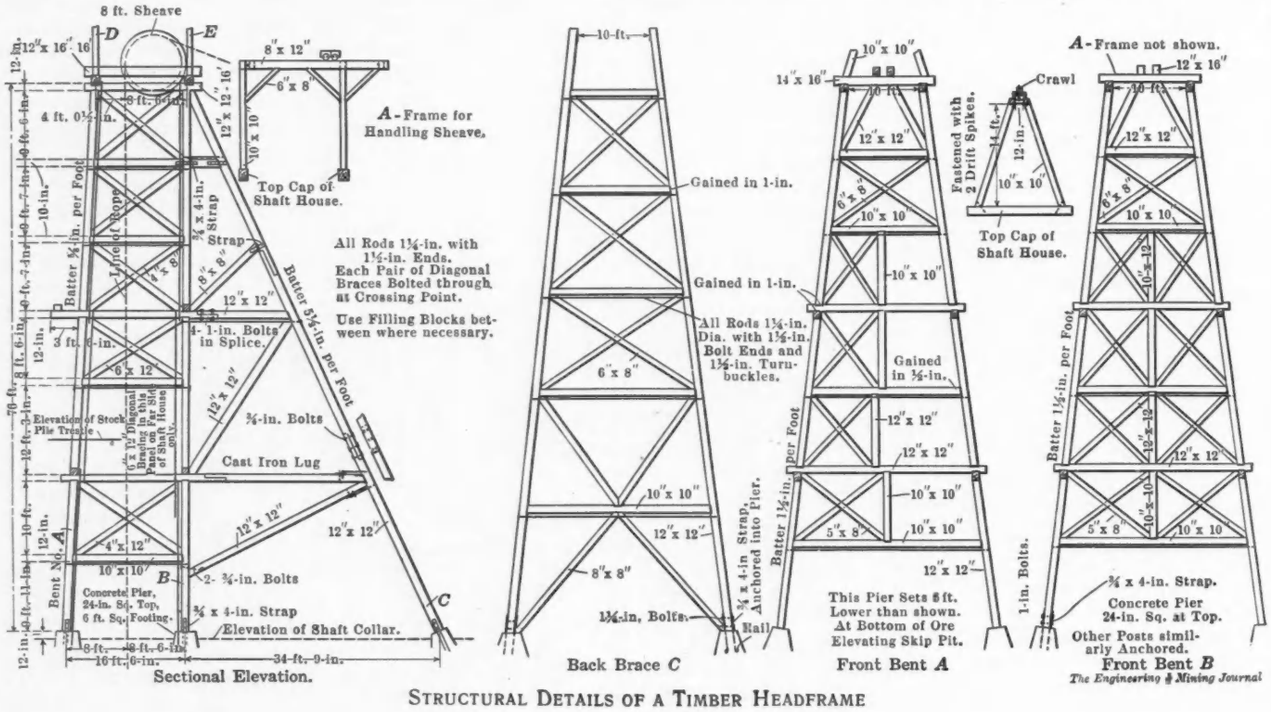
In the design of shaft houses or headframes, the engineer is often confronted by peculiar local conditions which materially influence the type of structure chosen. Where conditions are favorable, the "two-post" type of headframe is the most economical, alike in material required, and in erection cost. In many cases it cannot be used. The tendency of modern mining practice has been toward fewer shafts and larger outputs. This has often led to the installation of heavier hoists, and the construction of larger and stronger headframes.

In 1909 I designed a headframe to replace a smaller one for the Hiawatha shaft of the Munro Iron Mining Company at Iron River, Mich. At this shaft the conditions are rather abnormal. The engine house stands at an angle of 33 deg. with the shaft center line. The engine was originally placed square with the line to a foot sheave near the base of the old shaft house. When a larger hoist was installed, it was placed in the same building, but stood square with the line to the center of the hoisting compartment. The old shaft house was a 60-ft. tower, battered equally on the four sides, and stood square with the shaft. Hence the pull of the rope was at the angle of 33 deg. across it. This was not satisfactory, and in the larger, new shaft house would have been still more objectionable.

The new shaft house was designed to stand square with the line from shaft to engine, as in this position it could better resist the strains incident to hoisting. This necessitated dumping the skip at an angle through the shaft house, and likewise slightly longer timbers for supporting the shaft guides.

The four-post type of shaft house was chosen, as being best suited to the above conditions. It was designed to withstand the breaking strength of a 1¼-in. crucible-steel cable, with a factor for safety of three. The back brace was placed as near the resultant as possible without unduly lengthening the bracing back to the tower. The new shaft house was erected during the busy shipping season, when no delays to hoisting could be allowed. It was necessary to leave the old shaft house in commission until the new one could replace it. It was put up piece by piece, and where members of the old shaft house interfered with the new, they were cut out and temporary bracing put in as required. Work progressed in this manner until the new structure was high enough to carry the sheave supports of the old; after which its completion was an easy matter. To prevent anything falling down the shaft during the construction, the hoisting compartment was cased in with 1-in. boards, up to and covering the head sheave. Oregon fir timber was used throughout.

*Mining engineer, Iron River, Mich.


8 ft. Sheave
A-Frame for Handling Sheave.
Top Cap of Shaft House.
All Rods 1¼-in. with 1½-in. Ends. Each Pair of Diagonal Braces Bolted through at Crossing Point.
Use Filling Blocks between where necessary.
Batter ¾-in. per Foot
Batter 5⅛-in. per Foot
Cast Iron Lug
¾-in. Bolts
2- ¾-in. Bolts
¾ x 4-in. Strap
Elevation of Shaft Collar.
Concrete Pier, 24-in. Sq., Top, 6 ft. Sq. Footing.
Sectional Elevation.
Gained in 1-in.
All Rods 1¼-in. Dia. with 1⅝-in. Bolt Ends and 1⅝-in. Turnbuckles.
Gained in ½-in.
Batter 1½-in. per Foot
¾ x 4-in Strap, Anchored into Pier.
1¼-in. Bolts
This Pier Sets 8 ft. Lower than shown. At Bottom of Ore Elevating Skip Pit.
Back Brace C
Front Bent A
A-Frame not shown.
Crawl
Fastened with 2 Drift Spikes.
Top Cap of Shaft House.
Batter 1½-in. per Foot
1-in. Bolts.
¾ x 4-in. Strap.
Concrete Pier 24-in. Sq. at Top.
Other Posts similarly Anchored.
Front Bent B
The Engineering & Mining Journal

Structural Details of a Timber Headframe

Heating Concrete Buildings

As to the relation between the material used in construction and the heating of buildings, experience seems to show that with concrete floors it takes a greater time to heat the building for the first time than in the case of wood floors. However, after the building has once become heated it requires much less heat, according to *Cement Age,* to maintain a good even temperature than in the case of "mill construction," so that the maintenance of heat in the long run appears to be considerably cheaper with concrete than with mill construction. Where the heating bill is of considerable magnitude this feature might properly be seriously considered in connection with the choice of building material.

Area of Amalgamation Plates*

By W. R. Dowling†

Although there is no rule for the area of amalgamation plates there is no doubt that the number and area of plates in common use on the Rand are unnecessarily large and when these are placed in a separate plate-house the total area may be materially reduced. My opinion is that much of the amalgam found at the lower end of the long battery plate is largely worked down by the amalgamators, who wish to present a uniformly bright surface all over the plate.

The old practice was to install plates about 15 ft. long by 5 ft. wide for each battery of five stamps, which is equal to an area of 15 sq.ft. per stamp. Where, say, one standard large tube mill for 30 stamps is erected, and assuming that the tube mill is equivalent to 30 stamps, five plates 11x5 ft. would probably be used. The combined plate area is then; for 30 stamps, six plates, each 15x5 ft.

*Excerpt from a paper entitled, "The Amalgamation of Gold in Banket Ore," read at a meeting of the Chemical, Metallurgical and Mining Society of South Africa.

†Cyanide manager, Knights Deep mine, Transvaal.

equal to 450 sq.ft., or 15 sq.ft. per stamp; one tube mill, equivalent to 30 stamps, five plates each 11x5 ft., equal to 275 sq.ft., or 9 sq.ft. per stamp; total for 60-stamp units equals 725 sq.ft. or 12 sq.ft. per stamp unit.

At the Randfontein Central the total plate area amounts to 9.6 sq.ft. per stamp unit, but it is now proposed to use only 4.8 sq.ft. per stamp, and there is little doubt that the smaller area will be quite sufficient. In the Simmer & Jack rearrangement the plate area is about 2 sq.ft. per stamp.

With the high stamp duties of recent years the same plate area is doing nearly double the work it did in the past, and is capable of doing a great deal more. Conversely, in regard to the usual 10 per cent. fall, where this is increased more crushed material with smaller water ratio may be amalgamated with equally good results. H. W. McFarren, in his recent interesting book, says the fall of plates varies from 1½ in. to 3 in. per ft. and should not be less than 2 in. or 2½ in. A fall of 2 in. per ft. is equivalent to 16.7 per cent. and 2½ in. to 28.8 per cent., while the average is 18.75 per cent.

Among the advantages due to reduced area of plates are reduced costs of installation and operation and especially a reduced cost of mercury, the consumption being in proportion to the area of the plate. In the Simmer & Jack plants the consumption of mercury has been reduced to one-sixth of the former figure. Where a large area is exposed in amalgamation, a proportionate amount of gold is taken to set the plates, and is not available for realization until the end of the life of the plate. The gold held by the well set plates may be taken at one ounce per square foot of plate. A 200-stamp mill having 40 plates each 15x5 ft. will thus absorb 3000 oz. of gold.

The future points to the reduction of the use of plates to the point where only the gold too coarse for cyaniding will be caught by amalgamation. This point has probably been reached in the Simmer & Jack plant, which has now only 18 stationary plates in the tube-mill circuit in place of the former 64 battery plates and 30 shaking, tube-mill plates. It will be noticed that the Simmer East, with the plates in the stamp mill, has retained two stationary plates per tube mill, whereas the Simmer & Jack and the Simmer Deep-Jupiter joint plants have each retained three plates per tube mill. The additional plate in the last two cases is a measure for safety to have not less than two plates per tube mill in action during dressing operations.

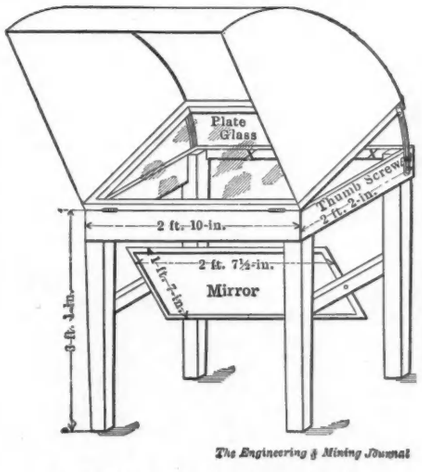
Owing to falling-off of the grade of the ground last year, the Premier diamond mine did 100 times the work it did in its first year (*Journ. South African Assoc. Eng.*), and made only 5½ times the profit.

Tracing Through Opaque Paper*

By A. T. Schwennesen†

Every engineer has occasionally to trace a drawing on thick paper. When the figure is small and simple a copy may be traced by holding the original against a windowpane, covering it with the paper. The need of utilizing this principle on a larger scale and in a more convenient position led Dr. J. C. Branner to plan the table herein described.

The device consists essentially of a drafting table, with a plate-glass top, upon which the original drawing and the paper are laid. A mirror mounted underneath reflects the light of the sky up through the drawing. The glass top is hinged and fitted with two arms and thumb screws, so that it can be raised, and fixed at any position. The mirror is pivoted and revolves about a horizontal axis. The hood of cardboard or black



Glass-bottom Drafting Table

cloth prevents the reflection of light from the tracing, and may or may not be attached to the table.

The apparatus is placed before a window, through which part of the unobstructed sky is visible. The mirror is then adjusted like the reflector of a microscope, so that the light is reflected up through the drawing. If the mirror can be so set that the direct rays of the sun are reflected through the drawings, thicker paper can be used. The map or drawing may be held in place by clips screwed to the top of the plate-glass frame, or by lead weights placed on top of it.

The accompanying illustration gives the dimensions and shows the general appearance of the table in use in the department of geology and mining at Stanford University. The dimensions may be varied to suit individual needs. An important point to be remembered is that in the construction of the table the piece marked *X* should be made as narrow as possible, so as not to shut out more light than necessary. The frame of the glass top should be made narrow at the top, for the same reason. This table can be used at night with an electric lamp, so placed that the light is reflected, or even shines directly up through the plate-glass top.

It sometimes happens that the light from beneath is inconveniently strong, but this objection can be obviated by cutting a small opening in a piece of thick or dark paper, which is laid over the drawing. The tracing can then be done through the hole and the sheet can be moved about at pleasure, which gives the advantage of preventing the tracing from being soiled, and it often brings out more clearly the lines to be traced.

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*Abstracted from an article in *Bull.*, A. I. M. E., May, 1911.

†Stanford University, Palo Alto, Cal.

Turbine Driven Centrifugal Pumps

For keeping mines free from water and for creating hydraulic power for placer mining, the turbine-driven centrifugal pump in its present development is peculiarly applicable. The small dimensions of such sets would commend their use where space conditions are important without deep inquiry into their other virtues. Turbine pumps can be started up at any time from a cold condition and once started operate for an indefinite time until stopped by the simple closing of the throttle valve. To those unfamiliar with the modern turbine and centrifugal pump, the power and speed of these machines is almost incredible. For example, a 5-stage centrifugal pump driven direct-connected by a single-stage steam turbine, is about 48 in. in hight and not over 10 ft. in length, yet has a capacity of 1000 gal. of water per min. against an average discharge pressure of 270 lb. The small size and simple construction is in striking contrast to the great weight of a reciprocating pump for the same service.

As a means of propulsion for centrifugals, the small steam turbine presents many advantages. Because of its superior range of speed it is possible to get a unit of much smaller diameter than would be necessary in a larger pump driven by a reciprocating engine. There is but a single row of buckets on the rotor. This single-stage feature reduces complications, but in order that the speed shall be normal the steam in the course of its expansion is made to traverse the buckets several times, each time being redirected against the wheel through return passages in the casing. The wheel thus receives energy in successive stages and therefore the peripheral speeds are much lower than would be the case if the steam impinged on the wheel but once.

Mines Timber Company

BUTTE CORRESPONDENCE

The Mines Timber Company, recently organized in Butte, of which John Gillie, general superintendent of the Anaconda company, is president, and D. A. Welch, secretary, has just purchased the timber interests of the Allen company, of which Lieutenant-Governor W. R. Allen is president and principal owner, for something over $200,000. The property lies in and near French gulch, 21 miles from Anaconda, and the transfer consists of 15,000 acres of timber land with all water rights, flumes, stores and machinery of the company, including two large saw mills. About 15,000,000 ft. of timber a year has been the production of the company, and recently a permit was obtained from the Government for the cutting of an additional 100,000,000 ft. of timber from the Deer Lodge forest reserve, and the sale was based upon this concession. The greater part of the timber production of this company, consisting of about 1500 cars annually, is being used in the Anaconda company mines at Butte. The Allen company also owns 22 mining claims in French gulch, which do not form part of the transfer to the Mines company, and which will be extensively developed this summer. While work has been done on all of the claims, it has been confined principally to three claims, the Spain, McKinley and Golden Crown. The Spain is equipped with a complete surface plant and a hoisting engine, having a capacity for hoisting from a depth of 1000 ft. There are about 16,000 tons of ore on the dump awaiting shipment when transportation facilities can be improved.

Milling the Hancock Ore

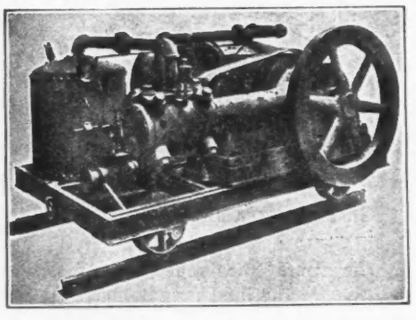
HANCOCK CORRESPONDENCE

The situation at the Hancock mine is commanding the attention of those interested in Lake Superior copper mines, for the reason that the first mill run on Hancock rock has completed its first month of operation. The rock upon which this run is being conducted is being taken entirely from the No. 3 West Hancock lode, which was intercepted by the No. 1 vertical shaft at a depth of approximately 2200 ft. something over a year ago. Much work done on the lode at this point indicates a copper content above the average and the mill run has been looked forward to with more than ordinary interest. Stamping and washing facilities were obtained at the Centennial mill and shipments from the mine began a month ago and have been maintained at the rate of 250 tons per day.

The general impression is that the recovery will show about 25 lb. of copper per ton of rock, which would indicate a final recovery of about 18 lb. of refined copper per ton of rock. While it is possible that these figures may be a disappointment to many if they are actually so, to most of those who are familiar with the various productions from the amygdaloidal mines, an average output of 18 lb. of refined copper would be highly gratifying. It would mean undoubted success, and doubly so since the Hancock is so equipped in every way with modern cost-reducing machinery that a low cost of production is assured. There are few mines in the Lake district that have been as fortunate as this one in having been able to lay out their plans in detail from start to finish before the ground for the main shaft was scarcely broken, and in the carrying out of these plans have been as fortunate in encountering virgin copper ground. It is not at all unlikely that the Hancock will continue to use the Centennial mill for an indefinite period and defer the building of its own mill for some time to come.

An Underground Compressor Plant

The use of the portable air compressor for mines often results in considerable economies in attendance, power, and plant, particularly in the length of piping required. An installation which has been in use in the Midway mine of the Chicosa Fuel Company at Rouse, Colo., for almost a year consists of a Sullivan "WK-2" single-stage compressor, connected by silent chain drive to a direct-current electric motor, and mounted, with its air receivers, on a steel truck. The compressor is fitted with an unloading device, and is of the center-crank, inclosed-frame, splash-lubrication pattern.



PORTABLE AIR COMPRESSOR

The apparatus is set in a station, cut in the coal at the side of the entry, and supplies power to two Sullivan direct-acting pick machines, which are used in cutting rooms and driving entries. The compressor is started at the beginning of a shift by a pump man, who is stationed a quarter of a mile from it, and no one goes near the machine again until the end of the shift. The unloading device reduces waste of power when the punchers happen to be idle. The air is supplied at 80-lb. receiver pressure, and runs through about 800 ft. of 2-in. pipe. It is then split and is carried to the machines by two 1-in. pipes, about 400 ft. long each. However, the machine will in future be kept nearer the working face.

Oil in Northern Alberta

SPECIAL CORRESPONDENCE

Three oil-drilling outfits are on the way to Fort McMurray in north Alberta, which will be put in operation this summer in that district and to the west of Pelican rapids. They have arrived at Athabasca landing, from which point they will be transported by barges down the Athabasca river. Over 50 oil companies have been chartered by the Alberta Government, and an oil boom is anticipated.

Though the oilfield is believed to extend practically over the whole province, as indicated by the discovery of gas wells and oil springs, geological research has shown that the stone capping overlying the oil deposits is thinner to the north of the Athabasca river than elsewhere. One of the rigs will be put in operation some distance back from Fort McMurray, in the hope of striking oil of a higher grade than that which comes to the surface at the various oil springs. A 14-in. hole will be driven as deep as possible, and if progress is blocked by the formation a smaller drill will be put down inside, and so past the gas belt to the oil deposit supposed to underlie it.

The great difficulty to be overcome is that of transportation, all material having to be teamed to Athabasca landing and thence shipped by rough barges through 90 miles of rapids. The barge is usually broken up when the voyage is finished and the lumber used for building. During the summer it is proposed to bring about three tons of the tar sands found at Fort McMurray to Edmonton to be thoroughly tested for pavement purposes. Numerous oil and paving companies in the United States have requested samples of the asphalt residium and crude oil found in the district, showing the interest which is being taken in the exploitation of this field. In the Peace River country, which is attracting a great rush of American immigration this season, a number of oil springs have been discovered.

Valuation of Michigan Mines

The legislature of Michigan, at a recent session, appropriated $40,000 to be expended by the Tax Commission of the State in making a new valuation of the mining properties of the State for the purpose of taxation, this to be done before the meeting of the State Board of Equalization in August next. J. R. Finlay has been appointed engineer to take charge of this work.

The Ore Reserves of the Rand

By A. Cooper Key *

The tendency at some Rand mines is to curtail development, while at others larger blocks of ore are being opened. From 80,000,000 tons of ore developed, a profit of £28,000,000 is expected.

*Editor, *South African Mining Review*, Johannesburg, Transvaal.

The Rand gold-ore deposits exhibit a persistency and regularity, elsewhere uncqualed, and developments have resulted in the blocking out of ore reserves of such magnitude as to give the mines a stability of which no other goldfield can boast.

Recoverable Value of Reserves

At the end of December the producing mines had 75,000,000 tons of ore in sight, while three developing mines in the eastern Rand had another 5,000,000 tons blocked out. The total value of these reserves is estimated at over £110,000,000 of which £93,500,000 may be said to be recoverable. The balance, representing the inevitable losses in mining, and in treatment, has been assumed as 15 per cent., which is, perhaps, a little low, but it is not unreasonably so in consequence of the different manner in which the ore reserves statements are presented and the fact that some of the mines state the value in terms of actual recovery. This is the soundest method as it leaves no room for ambiguity. It is the method adopted by J. G. Lawn, the recently appointed consulting engineer to the Johannesburg Consolidated Investment Company, which is closely allied to the house of Barnato Brothers, identified with the Rand since the discovery of the goldfield. In the case of the Goerz control, the consulting engineer, W. H. Cameron, indicates what proportion of the ore reserves may be considered recoverable, the factor assumed by him usually being 82 per cent. At the time of the historic Chamberlain report, the Rand engineers relied upon 75 per cent., but sampling methods have greatly improved of late years and the general adoption of closer mining and tube mills has advanced the extraction.

TABLE I. TRANSVAAL ORE RESERVES

	Tons	Tenor, Dwt.	Thickness, Inches
Aurora West	339,000	5.85	36
Banties	958,500	7.6	41
(Pillars)	87,000	7.6	41
Cinderella Cons.	422,000	6.8	.....
City Deep	2,273,000	8.2	58
(Pillars)	141,000	8.2	58
City & Suburban	829 000	7.2	.....
Cons. Langlaagte	401,000	(a) 6.37	.....
Deep Level	179,300	9.25	.....
Crown Mines	6,283,000	7.6	.....
Durban Rood Deep	867,550	6.7	.....
(Pillars)	194,426	7.3	.....
East Rand Prop.	10,250,000	6.6	.....
Ferreira	600,000	8.1	77
Ferreira Deep	1,779,000	9.6	.....
Geduld Prop.	445,000	9.09	37
(Probable)	102,300	10.7	41
Geldenhuis Deep.	2,521,500	6.1	46
Ginsberg	341,000	(a) 6.55	.....
Glencairn	1,121,000	4	.....
Jubilee	37,000	.....	.....
Jupiter	1,074,000	5.8	.....
(Partial)	320,000	4.98	.....
Knight Central	700,000	6	62
Knights Deep	(b) 1,700,000	5.5	.....
Lancaster West	431,000	6.76	39.4
(Pillars, etc.)	43,500	9.33	45.7
Luipaardsvlei,est.	398,000	.....	.....
Main Reef West	430,100	7.9	48
May Cons	300,500	.....	.....
Meyer & Charlton	249,000	8.6	.....
New Goch	742,000	5.3	53
New Heriot	485,600	8.4	46
New Kleinfontein	1,057,400	7.47	39.57
New Modderfontein	2,581,000	7	.....
New Primrose	491,000	(a) 7.8	.....
New Unified	285,000	(a) 6.8	.....
Nourse Mines	(b) 2,142,000	6.5	.....
Process Estate	283,000	8.6	.....
(Pillars)	11,000	12.6	.....
Randfontein Central	5,828,000	7.4	.....
Robinson Deep	(c) 1,100,000	7.2	.....
Robinson (Main Reef Leader and South Reef	1,794,000	11.77	.....
Robinson (Main Reef)	2,202,000	4.24	.....
Roodeport United	617,700	5.47	38.5
(Partial)	112,500	4.97	42
Rose Deep	3,553,500	6.1	55
Salisbury	162,000	.....	.....
Simmer & Jack	2,650,000	6 3	.....
Simmer & Jack East	925,750	5.4	.....
Simmer Deep	1,255,000	5.0	.....
(Partial)	114,000	5 17	.....
Van Ryn	1,591,000	6.4	.....
(Partial)	203,000	6.9	.....
Village Deep	1,704,000	6.1	61
Village Main Reef	1,775,000	.....	.....
Vogelstruis est.	223,500	.....	.....
West Rand Cons.	1,125,000	5.5	46
(Partial)	216,000	5.5	46
Witwatersrand	1,233,000	5.8	.....
Witwatersrand Deep	1,700 000	7.16	.....
Wolhuter	760,000	6.4	.....
Developing companies:			
Apex	75,000	.....	.....
Brakpan	1,720,000	6.56	.....
Benoni	606,000	6.4	.....
Modder B	2,788,000	7	48

(a) "Recovery Value." (b) July, 1910. (c) March, 1910.

Table I shows the quantity and tenor of the ore developed. Where thickness is not stated, the figures do not appear in the official records. The 80,000,000 tons of ore in sight have an extraction value of about 24s. per ton, and with working costs averaging 17s., there would be a margin of profit of 7s. per ton. It may, therefore, be calculated that there is a prospective profit of £28,000,000 in the ore in sight in the Rand mines. The grade figure compares with 28s. 6d. secured last year. But it must be remembered that current operations are greatly benefited from inclusion of ore from the richer mines in the neighborhood of Johannesburg, whereas the developed aggregate includes large quantities of ore of lower grade. It is quite possible that the eventual cost will be lower than 17s. per ton, in which case the prospective profit will be augmented in proportion.

Three Million Tons Exposed in Two Years

Of the three developing mines two are due to crush in the first half of this year, while the Modder B should begin crushing in the latter half. These three companies show an average value of reserves of 6¾ dwt. and it may be pointed out that only 45 per cent. of the tonnage standing developed in the producing mines exceeds that value. Brakpan stands out as an example of sound financing, while the rapid development accomplished on the Modder B is one of the most striking features of recent mining work on the Rand. It is only about 19 months since really serious work was started, but the company now has or will have 3,000,000 tons of profitable ore blocked out. As the chairman of the company recently pointed out, this figure is, if we include the Rand, equal to over half of the development of all other gold mines in South Africa and Rhodesia together.

Developments of Large Blocks

Owing to the flat dip in the eastern Rand, the area of blocks developed is much greater than in the central section. As values might be patchy, it was deemed advisable to avoid spending a considerable portion of the funds of the company in developing unprofitable areas in small blocks. On the Modder B the size of the blocks is 800x1000 ft., the development extending over a distance of 7000 ft. on the strike by nearly 2000 ft. on the dip. The consulting engineer, Stuart Martin, points out that the area of the blocks developed so far exceeds the total claim holdings of some of the mines of the central Rand. High-grade ore has been blocked out, the existence of which would never have been suspected had the funds been spent in developing small blocks around the shaft. But it is frankly admitted that in this scheme of development some risks are incurred in the estimation of the yield.

Samples taken at the periphery of these large blocks represent only the value in an approximate degree, and therefore allowances have to be made. A similarly cautious attitude is adopted in the case of the Geduld, which has been opened in much the same way. At the Modder B mine a mechanical haulage level is being driven in the foot wall of the reef across the whole property. Haulage roads driven in the foot wall will also serve as

main intakes for the air for ventilation of the mine. The main haulage level has been the means of avoiding the sinking and equipping of at least two vertical shafts which, during the life of the mine, represent a large saving of capital expenditure.

TABLE II. VALUE OF TRANSVAAL ORE RESERVES

(A) Producing Mines. Value as Stated	Tons	Approximate Value
Over 8 dwt.....	8,500,000	£15,000,000
Between 7 and 8 dwt.	24,500,000	37,500,000
Between 6 and 7 dwt.	28,500 000	37,700,000
Between 5 and 6 dwt.	10,250 000	11,550,000
Below 5 dwt.....	3,750,000	3,750,000
	75,500,000	£105,500,000
(B) Developing Mines All between 6 and 7 dwt.....	5,100,000	6,650,000
	80,600,000	£112,150,000

So far little unprofitable ore has been encountered. The company has now 3,000,000 tons of ore in sight equal to 100 months' supply for the mill. Though the figures may not be strictly comparable, it may be observed that the East Rand Proprietary, which has the record aggregate of tonnage, has 50 months' ore in sight, while the Crown mine has 40 months on the present crushing basis.

How the Ore Reserve Is Made Up

The bulk of the Rand's ore reserve has a value of between 6 and 8 dwt. About 11¼ per cent. is above 8 dwt. and 19 per cent. is below 6 dwt. The aggregate is made as shown in Table II. The two big Rand consolidations, the Crown Mines and the East Rand Proprietary, have augmented their ore reserves enormously during the last year, the former having some 4,500,000 tons in sight and the latter had 6,500,000 tons at the end of the year previous.

To the contrary, some of the companies have reduced the quantity of their reserves in consequence of the exclusion of certain blocks of doubtful value. In future, the tendency will be for aggregates to increase, but for values to lessen, owing to the smaller proportion of high-grade tonnage. With new producers like the Randfontein Central in respect of the new mill of 600 heads, City Deep and Brakpan, working at full pressure, there is every likelihood of the Transvaal output exceeding £3,000,000 per month before the end of this year.

Siam Tin Production

The output of tin in Siamese Malaya, according to the *Echo des Mines*, has reached 5175 metric tons. The most exploited region is that of the island of Tonka, a little to the south of the isthmus of Kra which, in 1908, produced 3713 metric tons of cassiterite, yielding black tin to the amount of 2302 metric tons. The neighboring province of Monthon Chumpon, situated a little to the north, but in the gulf of Siam, is rich in tin, especially in the districts of Lang-Suan and Lampun. The district of Monthon Chumpon will soon be provided with a railway, by which it is hoped its resources will be quickly developed.

The Western Branch of the Canadian Mining Institute

Victoria Correspondence

The tenth general meeting of the Western Branch of the Canadian Mining Institute was held at Trail, B. C., on May 18. William Fleet Robertson, provincial mineralogist and chairman of the branch, presided, and there was an attendance of members and visitors from various parts of the Kootenay and Boundary districts, the neighboring State of Washington, and the coast cities, Victoria and Vancouver. Two sessions were held—afternoon and evening.

The visitors were welcomed by the president of the Trail Board of Trade, after which several papers were read and discussed. These were: "The Burns Anthracite Coal Property, Alberta," by Alexander Sharp, Orient, Washington; "Costs of Operation at the Blue Bell Mine, Kootenay Lake, B. C.," by S. S. Fowler, Riondel, B. C.; "Notes on Property of Le Roi No. 2, Ltd., at Rossland, B. C.," by Ernest Levy; "The Standard Mine, Silverton, B. C.," by John Vallance; and (by title only) "Notes on the Lucky Jim Zinc Mine, Slocan, B. C.," by A. J. Becker; "The British Columbia Copper Company's Smeltery, Greenwood, B. C.; "The Van-Roi Mining Company's Concentrating Mill, Four-mile Creek, Slocan," and a description of the copper smelting side of the Consolidated Mining and Smelting Company's works at Trail. Summaries of several of these papers will be published separately.

H. Mortimer-Lamb, secretary of the Institute, who had journeyed from Montreal, Que., to British Columbia to attend the meeting, read a letter of greeting from Dr. F. D. Adams, president of the Institute, and explained the proposal of the council of the Institute to hold a semi-annual meeting in British Columbia in the autumn of each year; this to be as far as practicable similar to the general meeting of members held annually in one of the cities of Quebec or Ontario. It was recommended that the first of these proposed semi-annual meetings shall be held next autumn. The matter was referred to the incoming branch council with a recommendation that it further the efforts of the general council to make such semi-annual meeting a success.

An invitation to hold the next general meeting of the branch at New Denver, Slocan lake, B. C., in the vicinity of which town several important silver-lead mines and concentrating mills are being operated, was favorably received and referred to the branch council for its decision thereon.

A proposal that the provincial government be urged either to add to the staff of the Provincial Bureau of Mines, or employ mining engineers not on the staff, to do exploratory work in new districts in the province giving promise of becoming mining fields, was not adopted, it being considered that the meeting was not in possession of sufficient information to show that there exists a public demand for such action, or other reasons that would warrant its making such a recommendation to the government.

The result of the ballot for chairman and members of the branch council for the ensuing year was that Robert R. Hedley, of Vancouver, was unanimously elected chairman, while all but one of the 12 elective members of the branch council were reëlected, the only new member being M. E. Purcell, superintendent of the Center Star group of mines, Rossland. Mr. Hedley presided during the latter part of the evening session.

On Friday morning, May 19, some of the visitors were shown through the Consolidated Mining and Smelting Company's copper- and lead-smelting works and electrolytic lead refinery, at Trail, and in the afternoon spent several hours in the company's Center Star mines at Rossland.

Monazite

Monazite is a phosphate of cerium, lanthanum and thorium, with other rare metals, the value of which lies in the extraction of these metals for use in gas mantles, and as substitute for flint and steel. Monazite is a translucent to opaque mineral, ranging from gray to yellow, some also brown, red and green, with a specific gravity of 4.9 to 5.3 and a hardness of 5 to 5.5. It is suggested in a bulletin of the U. S. Geological Survey that small grains of monazite can readily be crushed between the teeth as a rough test to distinguish this mineral from other harder minerals of similar color, such as iron-stained quartz, epidote and staurolite.

The production of the United States for 1910 was about 99,301 lb. of monazite, for which the miners were paid about 12c. per lb. of concentrates produced, or about 3½c. per lb. for the crude monazite delivered by them. The imports in 1910 were 453,554 lb. of monazite, 5234 lb. of thorium oxide, and 177,056 lb. of thorium nitrate.

The *American Fertilizer* states that at present all the phosphate rock mined in the Idaho-Wyoming-Utah area is being sent to California. The present consumption of commercial fertilizers in California amounts to about 40,000 tons, having increased from 10,000 tons in four years.

Driving the Strawberry Tunnel

By Edward R. Zalinski*

A description of the equipment and routine adopted by the United States Reclamation Service in driving a four-mile concrete-lined tunnel for irrigation water for Utah Valley.

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The Strawberry project was undertaken by the U. S Reclamation Service for the purpose of irrigating about 60,000 acres of land in Utah valley, about 60 miles south of Salt Lake City, on the east and south shores of Utah lake. The project includes the driving of a tunnel through the west side of the Strawberry basin to bring water into the Spanish Fork river, from where it will be sent into canals and distributed.

The Strawberry tunnel starts in Utah county, and runs easterly into Wasatch county. Modern efficient equipment has been provided for the undertaking and everything necessary for economical work has been installed. A wagon road 22 miles long was built from a Government siding on the Denver & Rio Grande railroad, about two miles north of Thistle Junction, to Camp Quinton at the west portal of the tunnel. Freight is hauled by contract in 5-ton loads to Camp Quinton at $7.90 per ton. The distance from the siding to the east portal is 28½ miles.

Power Plant

A power plant was built near the mouth of the Spanish Fork river, the equipment of which includes two 600-h.p. American turbines each connected with a 450-kw. General Electric generator. A head of 127 ft. is obtained. Water is brought by a 3¼-mile canal from the Spanish Fork river. There is a concrete diversion dam 16 ft. high and 70 ft. long. The canal has a capacity of 500 cu.ft. per sec.; 8000 ft. of it is lined with concrete, and there is 1500 ft. of tunnel. When the Strawberry project is finished, one-half of the water will be sent through the power house, and the remainder will be turned into the high-line irrigation canal on the edge of the valley. The water, after it has passed the power plant, will also be used for irrigation. At present out of 1200 h.p. available, about 350 h.p. is being used in driving the Strawberry tunnel. Light and power are also supplied to the city of Spanish Fork. The power and telephone lines extend to the west portal of the tunnel, a distance of 30 miles.

The building of the dam on the Strawberry river will be started as soon as the tunnel is well advanced and both will be completed at the same time. The depth from the surface to the tunnel is too great to allow shafts to be sunk to form intermediate headings.

Camp Quinton is near the head of Sixth Water cañon above the west portal of the tunnel. The altitude is 7648 ft. Comfortable quarters, both bunk house and cottages, have been provided for the men. A pool and a reading room have been provided for the use of the employees. No liquor is allowed in the camp. Wages paid are: Machine men, $3.50; chuck tenders, $3.25; muckers, $2.75; outside men, $2.25; motormen on train crew, $3.25. About 125 men are employed.

The Strawberry Tunnel

Work has been commenced at the west portal of the tunnel and on account of water and consequent necessity of pumping at the east portal, the greater part of the tunnel will be driven from this side. The grade is 3 in 1000 ft., the west side being the lower.

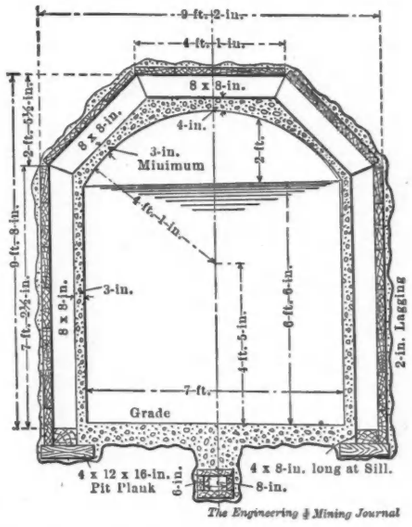

FIG. 1. SECTION STRAWBERRY TUNNEL

The tunnel is driven nearly due east and cuts limestone, sandstone and lime-shale beds, which strike approximately north and south and dip 12 to 22 deg. east. The greater part of the tunnel is in a compact blue limestone. It is 9x11 ft. in section as broken, and when finished will be 7x8½ ft. inside. It will be lined with concrete. When 500 cu.ft. of water per second is being delivered, the depth will be 6½ ft. above the floor, or up to the beginning of the arch. The cross-section is shown in Fig. 1 and a table shows the discharge and coefficients for various depth of water, as computed by the reclamation service, according to Kutter's formula. I am indebted to G. L. Lytel, engineer of this project, for the data, and illustrations. The drain shown below the tunnel in the section was only carried during the first part of the work, and has been abandoned.

An electric-haulage system has been installed. The track is 24-in. gage and is laid with 25-lb. rails. A 50-h.p. 3½-ton General Electric locomotive handles a train of six to 10 cars. The cars are of steel with heavy bottom plates and solid axles; the capacity is 47 cu.ft., and as loaded approximately 2½ tons of rock is carried. At present the train consists of 10 cars, making 25 tons of waste per trip. From two to three trips are required to clean up after shooting.

Dumping Apparatus

A time- and labor-saving device for unloading the cars is being used, which consists of a derrick that picks the cars bodily from the track, turns them over and dumps them. The derrick is moved once a month at a cost of about $15. Otherwise it would be necessary to employ two men per shift to handle the cars and keep up the dump while in winter on account of the heavy snows three or four men would be required.

The train crew, which consists of two men, do their own dumping. The derrick is made by the American Derrick and Hoist Company, of Minneapolis, and is operated by a 40-h.p. motor connected with the 250-volt traction circuit. The capacity is rated at 7½ tons, but it is capable of handling more. A car loaded with muck weighs about four tons. The boom is 50 ft. in length, of 14 by 14 in. timber; extra booms are kept on hand, but so far have not been needed. In general, it is customary to keep extra parts for all the machinery. The initial cost of the dumping apparatus was $3000 and it has more than paid for itself. It works smoothly and gives entire satisfaction.

Drilling and Blasting

The heading crew consists of five muckers, two chuck tenders, two drill men and a shift boss. Three shifts of eight hours are worked, and each shift mucks out, drills and shoots one round of holes. Two Sullivan 3¼-in. drills are used in the face. It is usual to put in 18 holes, 9 on each side, which average 6 ft. in depth. The arrangement of holes is shown in Fig. 2. The holes are shot or exploded in the order that they are numbered; 120 to 150 lb. of 40 per cent. gelatin is used to break each round. No powder is kept in the tunnel; it is

brought in just before shooting. The cut holes and lifters are loaded somewhat more heavily than the other holes. This loading depends on the ideas of the shift boss and the character of the ground. A car with seats is attached to the train to take the heading crew in and out.

Air is delivered at 85-lb. pressure at the face by a 4-in. standard air pipe. The pressure at the compressor is 90 lb. As the tunnel is broken 9x11 ft. in the clear, the face is carried 9 ft. wide by 8 ft. high some two or three rounds in advance of the floor, leaving a 3-ft. bench in the bottom. This is afterward shot out and the tracks kept up to within 15 ft. of the face. In Fig. 2 the bench holes are shown.

The ground holds well, but considerable timbering has been required in fractured zones and on account of the limestone disintegrating on being exposed to the air. A number of fissures have been cut, some of which showed copper staining; some pyrite is occasionally seen. The land near the tunnel is not classed as mineral but has been withdrawn from

DISCHARGE AND COEFFICIENTS FOR VARIOUS DEPTHS OF WATER IN STRAWBERRY TUNNEL ACCORDING TO KUTTER'S FORMULA

Depth	Wetted Area in Square Feet	Wetted Perimeter in Feet	r	n	s	c	Velocity in Feet per Second	Discharge in Cubic Feet per Second
2 inches	1.2	7.33	0.16	0.012	0.003	85	1.87	2.24
4 inches	2.3	7.67	0.30	0.012	0.003	99	2.96	6.81
6 inches	3.5	8.00	0.44	0.012	0.003	110	3.96	13.86
8 inches	4.7	8.33	0.56	0.012	0.003	115	4.70	22.09
10 inches	5.8	8.67	0.67	0.012	0.003	118	5.33	30.91
12 inches	7.0	9.00	0.78	0.012	0.003	123	5.92	41.44
2 feet	14.0	11.00	1.27	0.012	0.003	132	8.21	114.9
3 feet	21.0	13.00	1.62	0.012	0.003	139	9.61	201.8
4 feet	28.0	15.00	1.87	0.012	0.003	141	10.54	295.1
5 feet	35.0	17.00	2.00	0.012	0.003	142	11.00	385
6 feet	42.0	19.00	2.21	0.012	0.003	145	11.74	493
6 feet 6 inches	45.5	20.00	2.28	0.012	0.003	145	11.98	545
7 feet	48.9	21.2	2.31	0.012	0.003	146	12.08	591
8 feet	54.1	23.4	2.31	0.012	0.003	146	12.08	653
8 feet 6 inches	55.4	28.4	1.95	0.012	0.003	142	10.82	599

r = hydraulic radius. n = coefficient of roughness. s = slope. c = coefficient deduced from Kutter's formula.

entry for a width of two miles until the tunnel is finished. American Fork, about 35 miles distant, is the nearest mining camp.

Air and Lighting Equipment

Air for ventilation is furnished by a Roots blower driven by a 40-h.p. motor and placed in a station 4000 ft. from the portal of the tunnel. The blower is run at full speed for 20 min. after shooting, and at half speed the rest of the time. When running at full speed it handles 3000 cu.ft. of air per minute and is so placed as to be approximately in the center of the air column being moved. At present the blower is pushing 4000 ft., and pulling 6200. Air from the face taken at various times shows from 6 to 10 parts of carbon dioxide in 10,000. It is planned to keep the carbon dioxide below 15 parts. A second Roots blower of the same capacity as the first will be installed in series when the 11,000-ft. point is reached. The ventilating pipe is made of No. 16 iron, and is 14 in. diameter. This comes in 4-ft. lengths nested, with the rivet holes punched. It is put together in 16-ft. pieces, and tarred before being taken inside.

Electricity is used for lighting, 16-c.p. lamps being placed at about 120-ft. intervals. Wires from the traction circuit, light and phone are carried by 4x4 posts set in the side of the tunnel 40 ft. apart. Water is drained by a ditch, the flow amounting to 400 or 500 gal. per minute.

The compressor building and transformers are near the entrance of the tunnel. Current from the power plant at the mouth of Spanish Fork is received at 22,000 and transformed down to about 2200 volts. An Ingersoll-Rand Imperial compressor having a capacity of 427 cu.ft. of free air per minute is belt driven by a motor-generator set. The motor is 125 h.p. at 2080 volts and beside driving the compressor is connected by a shaft to the generator that furnishes the 250-volt direct current for the traction, light, ventilation and power circuits. The last is used to run the machine, carpenter, and blacksmith shops, also to heat the drying room, and thaw the powder. A second motor-generator set is placed at a station 7000 ft. from the portal of the tunnel and adds its 250-volt direct current to the main traction and power circuits.

Concrete Work

The plant for mixing concrete is just south of the compressor building. Sandstone obtained along the road is hauled in wagons and emptied into a Gates crusher, which crushes to 1½ in. The rock passes through 14-in. rolls and is raised by a bucket elevator to the top of the building. Here it passes through a trommel having from ¼-in. up to 2½ in. screens. The undersize goes into the sand bin and the oversize into the coarse rock bin.

Below these bins is the concrete mixer, with measuring arrangements for the ingredients. Portland cement is brought from the adjoining warehouse by a belt elevator. A 75-h.p. alternating-current motor, 2080 volts furnishes operating power. The tunnel was in 10,450 ft. on December 15 and several thousand feet of the heading was lined with concrete; the concrete lining is 4 to 8 in. thickness. The work is to be done in 1000-ft. sections. In laying the floor, water is taken over the freshly concreted part by an 8-in. iron pipe for four or five days until the concrete is thoroughly set, when the pipe is removed to the next section. The timbers used in the lining are 8 by 8 in., and the sets are from three to six feet apart. Special cars of two types have been provided to handle the concrete. These are of 18 and 27 cu.ft. capacity, the former being boat-shape and set high on the trucks to allow concrete to be readily shoveled into the upper part or arch ring of the tunnel. The cars have small folding platforms on the side for the men to stand on while shoveling. The 27-cu.ft. cars are V-shaped and side-dumping.

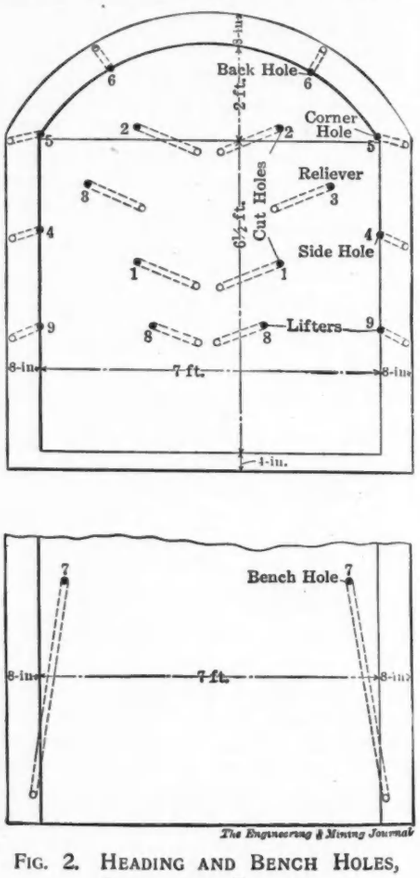

FIG. 2. HEADING AND BENCH HOLES, STRAWBERRY TUNNEL

The machine, carpenter and blacksmith shops, containing a Sibley & Ware power drillpress, Hendrie & Bolthoff lathe, Curtis planer and saws, are in the yards near the tunnel entrance. Two blacksmiths sharpen all the steel in one shift of eight hours. A large supply of extra steel is kept on hand which enables the work to be done in this time. Each shift boss has a set of tools issued him for which he is responsible.

Progress

The project engineer superintendent and some of the men were formerly employed at the Gunnison tunnel in Colorado and have the benefit of this experience. Care has been taken to avoid the difficulties encountered in the former work and rapid progress has been made. In addition to their regular wages the men receive a bonus of $6 per ft. for everything over 400 ft. in a month. This is divided among the three shifts as follows, for every extra foot driven; 3 shift bosses, each 28c. $0.84; 6 drillmen and 6 chuck tenders, each 23c. $2.76; 15 muckers, each 16c. $2.40.

Work was started at the west portal during the fall of 1906. After driving 1567 ft. with a temporary power installation of gasolene engines, work on the heading was suspended until January 1909. Up to this time 1613 ft. had been driven. During 1909, the progress was 3992 ft. working a part of the time with only two shifts. The monthly progress in 1910 averaged 426 ft. for the first 11 months of the year. During October, 492 ft. were driven, or an average of 15.87 ft. daily, this being 5.29 ft. per shift. The progress during November was even better, as up to the middle of the month an average of 17 ft. had been made. On Nov. 1, the face was in about 9700 ft. When completed, the tunnel will be 19,200 ft. in length.

Cost of Tennessee Copper Company's Acid Plant

From the report of the Tennessee Copper Company it appears that up to Dec. 31, 1910, acid-plant construction has cost $1,689,925. At that time the annual capacity of the plant was estimated at about 168,000 tons of 60-deg. acid, or a cost for the plant of about $10 per ton of annual capacity. Figuring on a 10-year depreciation period, amortization and interest charges will cost the Tennessee Copper Company about $1.60 per ton of acid.

Analysis of Ferro-Uranium

From 0.4 to 0.6 gram of the powdered alloy is heated with *aqua regia* until solution is complete, after which the liquid is diluted, cooled and made alkaline with solid ammonium carbonate. After standing for 24 hours, with frequent stirring, it is filtered and the filtrate boiled to decompose the remaining ammonium carbonate, precipitating most of the uranium. The traces of uranium in the filtrate are removed by adding a few drops of ammonia solution, and the liquid is again filtered. The filter containing the uranium precipitates is washed with ammonium nitrate solution until only faintly ammoniacal, and the precipitates ignited in a porcelain crucible and weighed as U_3O_8. Aluminum, a frequent impurity in ferro-uranium, is determined by fusing the powdered sample with sodium peroxide, extracting the fused mass with water, acidifying the solution with hydrochloric acid, and precipitating the aluminum and silica by means of ammonia, the silica being subsequently separated by means of hydrofluoric acid.

Sunlight Mining District, Wyoming

By J. H. East, Jr.*

The Sunlight mining district is situated in the northwestern corner of Park county, Wyo., 10 miles from Yellowstone National Park and 30 miles from the Wyoming-Montana State line, and covers an area five miles long and four miles wide. The district includes the Stinking Water divide of the Absaroka range. No sedimentary rocks are found in the district but to the east, in Sunlight basin, a distance of ten miles, are Cambrian limestones, clays and shales forming conspicuous cliffs, and Carboniferous limestones in castle-like hills. Tertiary lavas have intruded filling the uneven spaces of these sedimentary beds.

These have been termed Sunlight intrusives and occur in stocks, sheets and dikes. The largest body of these intrusives is found on the divide between Stinking Water river and Sunlight peak across Sulphur, Fall and Copper creeks. It is an indurated breccia varying from quartz-augite syenite to a gabbro. The base on which the mountains have been built is a granitic porphyry and at several places the overlying rocks have been eroded leaving it exposed in large masses. Above this is an andesitic breccia varying in thickness up to a thousand feet. The next flow was a heavy, dark breccia which serves as a capping in many places for the veins that cut through the granitic porphyry and andesitic breccia. Later flows of breccias and porphyries built the mountains to their present hight.

Ore Occurrence

The ore occurs in three general ways, namely: fissures, mineralized dikes and bodies of low-grade ore. The fissures are in granitic porphyry or andesitic breccia. Fissures near the base of the mountain have sulphides of the metals outcropping at the surface, due to glacial erosion. This is well illustrated by the Bluff vein of the Winona Gold-Copper Mining and Milling Company. The vein is 30 ft. wide in andesitic breccia with the sulphides of copper occurring in large bunches with smaller particles desseminated through the entire vein. The fissures higher on the mountain show no effects of erosion and the ores are the usual oxidized ores of copper with traces of secondary enrichment. Examples of this are the Hargrave-Newton La Fond mine on Sunlight creek and the Malachite vein of the Winona company. The Malachite vein is a fissure filled with the carbonates of copper, malachite and azurite, and with seams of chalcocite. Mineralized dikes are found in all parts of the district cutting through all formations. The general strike is in an easterly and westerly direction but some crosscutting dikes are found striking nearly north and south. The dikes are porphyritic in texture and the minerals are bornite and chalcopyrite. An example of this is the Greenhorn vein of the Winona. This dike is typical of many in the district, porphyritic in texture, slightly altered, with chalcopyrite disseminated across its width with the heaviest mineralization near the walls.

Low-grade deposits are exposed in several places by glacial erosion and are always in conjunction with the strong fissures. These orebodies are in granitic porphyry with a capping of andesitic breccia remaining at some points. The seams vary in width from ⅛ to 3 in., being filled with quartz and sulphides of copper such as chalcopyrite and bornite. The largest example of low-grade deposits is the Marvin deposit belonging to the Winona company. This deposit covers an area 2200 ft. long, 1000 ft. wide and is exposed by glacial erosion to a depth of 250 ft. The deposit is evenly mineralized over the entire area, the seams striking nearly east and west with crosscutting seams striking north and south. The ore in this deposit carries gold, silver and copper, containing enough gold to pay treating charges. Another low-grade deposit of a different type is a mineralized area on each side of the Bluff vein of the Winona company. The andesitic breccia through which this vein cuts contains chalcopyrite disseminated through it for a distance of over 200 ft. on each side of the vein.

Mines of the District

The largest mine of the district belongs to the Winona company. This company has a tunnel 750 ft. long with a drift 150 ft. in length. The tunnel cuts a vein at 630 ft. averaging 2 ft. in width having well defined walls with the sulphides of copper occurring in lens-shaped masses. The andesitic breccia through which the tunnel is being driven has had sulphides of copper and iron disseminated through it for the last 150 ft. The tunnel is being driven by electric drills, the power being furnished by a combination steam and electric plant. It is planned to install a milling and smelting plant during the summer of 1911 and a narrow-gage railroad to transport the ore and smeltery products from the district to the standard railroad.

*Mining engineer, Painter, Wyo.

The Painter mine is on the west side of Stinking Water divide in Silver Tip basin. The geology conforms with the general geology of the district. The ore is chalcopyrite carrying gold and silver with some lead. A tunnel 900 ft. in length has been driven along the strike of the vein, attaining a depth of 150 ft. The mine has not been worked for several years. The Hargrave-Newton-La Fond property lies on Sunlight creek across the mountain from the Winona mines. A tunnel over 200 ft. in length and numerous shorter tunnels have been driven to develop the mine but the work has been intermittent. The ore at the outcrop is malachite, chalcocite, and chalcopyrite in a fissure cutting through a porphyritic formation. The McClung mine lies at the base of Stinking Water peak and Bear Tooth mountain. A tunnel 150 ft. long has been driven along the vein and numerous open cuts show the ore outcropping at the surface. The ore is galena mingled with chalcopyrite in a fissure in quartz porphyry. The ore also carries gold and silver. Numerous prospect holes in the district show copper, but little development work has been done except the yearly assessments.

Hunt & Douglas Copper Process

By R. C. Canby*

The renewed discussion of the lixiviation of copper ores possibly makes some account of the two principal operating difficulties of the Hunt & Douglas process, as encountered in its only important installation, of general interest. Theoretically, the Hunt & Douglas process seems to present an ideal treatment for leady copper mattes, as the lead, silver and gold are promptly returned as bullion through the smelting of an excellent iron flux, and an equally prompt production is made of an almost chemically pure copper, by the smelting of the suboxide, thus avoiding the heavy interest charges which are incurred in the slower electrolytic refining.

The Hunt & Douglas plant at the Argentine works of the Consolidated Kansas City Smelting and Refining Company, with its Brown horseshoe and double-decked Pearce turret roasting furnaces for the matte, its immense revolving cylinder-type furnace for producing the sulphurous-acid gas from pyrite concentrates, the lixiviation plant with its stir tanks for leaching copper from the matte, the storage tanks with the accompaniment of gas pumps, montejus, reducing towers, and its enormous German wooden-frame filter presses for removing the residue from the solutions, was one of the most extensive of the copper lixiviation works. The refining department had cupola furnace for smelting the suboxide into blister, and reverberatory refining furnaces for refining the copper.

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Technique of the Process

The process is carried out with the following operations: The sulphuric acid in the stir-tank solution (regenerated in the reducing tower), produces copper sulphate from the copper oxide in the roasted matte. The oxide of iron is but slightly attacked by dilute acid. The sulphate of copper is chloridized, by common salt in first starting, but for continuous operations by calcium chloride, which is currently produced in transforming cuprous chloride into suboxide by stirring in an emulsion of quicklime. The cupric-chloride solution is submitted to the action, in reducing cones, of sulphurous acid gas, gives practically the reaction of the Roesler sulphuric-acid process.

$$CuSO_4 + CuCl_2 + SO_2 + 2\,H_2O = Cu_2Cl_2 + 2\,H_2SO_4.$$

In the conversion of cuprous chloride to suboxide, we have the reaction:

$$Cu_2Cl_2 + CaO_2H_2 = Cu_2O + CaCl_2 + H_2O.$$

This precipitation of the cuprous chloride was somewhat crudely performed in stir tanks and the suboxide removed in an ordinary iron filter press.

Operating Difficulties

The above outline of the process will assist the reader in an appreciation of the two operating difficulties referred to.

When operations were started, the filter presses delivered the residue in solid, well washed cakes, but after a time the residue was returned to the lead-smelting department in a sloppy mass, containing so much sulphate of copper that iron wheelbarrows and shovels used on the furnace feed floor were rapidly destroyed.

For many months, every effort was made to overcome the difficulty by trying better grades of canvas for filter cloths, which would not choke up. Then, this supposed clogging of the filter cloths was attributed to gelatinized silica from slag adhering to the matte. I was, at this time, in the lead-smelting department, and was able to show that the mattes did not average over 2 per cent. SiO_2, and took distinct issue as to so small a proportion of slag in the matte accounting for the difficulty, even were the slag acted upon by the dilute mill solutions. I was then placed in charge of the copper department. The manner of operating the residue filter presses was to run the contents from the stir tanks into the montejus, and then filter press, washing first with weak solution which, by this enrichment, became "mill solution," then by wash water, which thus became weak solution.

In order to study the performance of the filter press, I had one opened as soon as filled, before doing any washing, when to the great surprise of everyone, the frames were found to be solidly filled with good, firm cakes of residue, such as had not been seen for many months. But an examination of these cakes showed the residue to contain a large proportion of minute, sparkling crystals. Now, these crystals were due to the fact that to avoid filtering out calcium sulphate, instead of chloridizing with calcium-chloride solution, salt from the nearby Kansas saltfields was continuously used, the mill solution thus becoming surcharged with sodium salts. These crystals, however, being soluble in the wash water, left the frames partly filled and the residues settled to the bottoms of the frames, so that the wash water largely passed over the top of, instead of washing the residue. This excess of soda being removed from the mill solution, by suitable change in the operation, the presses worked all right again, and a cheap grade of unbleached muslin was used in place of the more expensive duck.

Copper Chloride not Completely Decomposed

The other difficulty was much more serious in that it had caused an unsuspected, and yet considerable loss of copper, contrary to the belief which had been held, that there was no copper loss in the process. The gases from the cupola in which the suboxide of copper was smelted, before passing to the stack, ascended through a tower filled with coke, down through which water was sprayed. This coke I replaced by pieces of limestone. After a few days it was evident that the limestone was rapidly dissolving. The cause for this was found to be due to the presence of chlorides in the suboxide of copper, which caused a heavy volatilization loss of chloride of copper —a loss which was prohibitive—so that the process was abandoned, the plant being converted into one for the production of sulphate of copper which, at the time, offered an attractive field.

I have always felt, however, that the Hunt & Douglas process is so perfect in its theoretical reactions, and offers such prompt realization of values from leady copper mattes and so completely eliminates arsenic, bismuth, etc., from the copper product, that some effort should have been made to overcome this remaining operating difficulty.

L. O. Armstrong, of the industrial department of the Canadian Pacific railway, states that extensive deposits of white silica sand suitable for the manufacture of high-grade glass, have been discovered on the Canadian shore of Lake Huron, 28 miles east of Sault Ste. Marie. Samples of the sand, containing from 96.82 to 99.75 per cent. silica, have been shipped to glass manufacturing firms in the United States and Europe.

Magnetic Surveys of Iron Deposits

By Ralph S. Archibald *

A discussion of the methods of magnetic surveying with sun dial and dip needle, as used in the Lake Superior region for prospecting deep-seated iron-ore deposits.

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Magnetic surveying has long been employed in the Lake Superior iron district as a method of prospecting for iron ore. It has become in recent years, more and more important as the more easily discoverable orebodies have been found and the attention of prospectors has been turned to those regions in which surface indications have been meager on account of the heavy covering of drift.

The Lake Superior iron districts of Michigan, Wisconsin and Minnesota are in a region of marked glacial action. Certain of the ranges are regions of glacial erosion, while others are of glacial deposition. The Marquette and eastern part of Menominee, Gogebic and parts of Vermilion and Mesabi are covered by but a slight overburden of drift. This results in bountiful exposures of rock surfaces which have yielded detailed data regarding contacts of formations. Even on these ranges magnetic work has been found important, although not so necessary as in the more heavily covered districts, such as the Crystal Falls and Iron River ranges in Michigan and Cuyuna range in Minnesota. On these ranges the thickness of the overburden often reaches 150 to 200 ft. Miles of the country underlain by iron formation are absolutely devoid of rock exposures. These are the districts where magnetic work in the early stages of the development of orebodies is of prime importance.

Occurrence of the Ore

The iron ores consist mainly of soft, red hematites, which are not magnetic. Exceptions to this rule are found in practically all the ranges, especially on the Marquette, in the presence of considerable bodies of hard hematite and magnetite. But these occurrences are local, the magnetite probably being a product of metamorphism from hematite by the action of igneous agencies. For this reason it will be seen that the actual presence of the orebody will not be indicated by magnetic phenomena. Therefore, the magnetic work of this country in contrast with the work in places where magnetite is found in merchantable quantities might be styled an indirect method of prospecting.

In order to understand the principles of magnetic work in this region a slight knowledge of geological formation is necessary. The unaltered ore formation consists of siderite, sideritic slates, sideritic chert, magnetite-grünerite schist and iron silicate called greenalite. The only one of these original formations that is magnetic is the magnetite-grünerite schist and the magnetite in this schist is believed by some authorities to have been deposited by organic life in the sea and by others, that it originated from thermal methamorphism of some of the other iron-bearing sediments. The alterations from these original sediments are found in the form of hematites, limonites, jasper, jaspilites and taconite. These original formations were deposited as sediments.

The ore was concentrated from these original sediments by surface waters. The usual occurrence is in structural basins produced by folding of the strata. Other favorable places are in troughs formed by the intersection of intrusive dikes and sheets, either with the foot-wall of the iron formation or with themselves. It is also believed by many that ore is found in zones of brecciation in an otherwise solid rock where the surface waters have attacked the brecciated material and deposited it lower down where the waters have been dammed up. In a wide band of iron formation it is often the case that the large bodies of soft ore are found close to the bottom, and almost in contact with the foot-wall of slate or quartzite which has formed the impervious base for them. Exceptions to this, of course, are the orebodies formed in troughs produced by an intersecting dike.

Zones of Magnetism at Contacts

From this brief outline of the structure of the orebodies it will be seen that any method of tracing the surface contours of the footwall, or, in fact, any contour of any sedimentary bed intimately associated with the ore, will be of great importance in locating structural troughs where the ore is likely to be found. In the case of deposits formed by the intersection of intrusives, any method that will locate the exact position of the contact between the iron ore and the intrusive will be of use in determining where to drill for these orebodies.

As has been previously stated, the majority of the orebodies themselves and also the inclosing rocks unaltered by the effects of metamorphism by igneous intrusion, are nonmagnetic, but fortunately for the magnetic prospector it often happens, especially in the Crystal Falls, Iron River and Cuyuna districts, that there is found magnetic slate intimately associated with the ore. The tracing of the location and strike of this slate gives an indication of the situation of the ore, and also of structural troughs. In the case of orebodies formed by intersecting dikes it has been found in many instances that the contact of the dikes and iron formation was magnetic; thus it is possible by magnetic means to map these contacts.

Instruments for Magnetic Surveying

The usual instruments used in this region for magnetic work are the sun-dial compass and dip needle. These instruments are both of prime importance, although much of the work has been done with the dip needle alone.

The sun-dial compass is an instrument that was invented by Burt for land surveying in districts of magnetic attraction. The common type consists of a 3-in. magnetic needle mounted in a circular box around the upper outside edge of which is placed the hour circle graduated for the latitude in which the observations are to be taken. Different graduations are furnished by the maker for each one-half degree variation in latitude. In the line of the meridian, or in the positions of noon and 6 p.m. are mounted vertical sight standards. A silk or linen thread is attached to the standard placed in the position of noon and is stretched across the dial in the plane of the meridian. This string, called the gnomon, makes an angle with the horizontal equal to the latitude. The standard should have different points for attachment so that the inclination of the string can be varied to agree within a half degree with the latitude of the place where the observations are made. The usual method of doing this is by having holes punched at different hights on the standards marked with the corresponding latitudes. A more desirable form would be a vertical standard with a variable adjustment which could be made to slide up and down the standard by means of an adjusting screw and which would carry the hole through which the thread could be made fast. The instrument as a rule is provided with level bubbles and is made to set up on a single vertical stick or Jacob's staff.

The method of operating the sun dial is as follows: When the instrument is set up with the standards in a north-south plane, the shadow cast by the gnomon on the dial will indicate the correct apparent solar time. Therefore, in order to obtain a true north line it is only necessary to orientate the instrument so that the shadow indicates this time. In order to get correct apparent solar time from standard time two corrections are necessary; to subtract or add the difference in time corresponding to the number of degrees west or east of the standard meridian at which the observation is taken. This will give mean solar time, to

which time must be added or subtracted a correction, the equation of time from solar ephemeris for the day, month and year of the observation. Example: Longitude of place of observation equals 88½ deg.; date of observation, Nov. 1, 1908; standard 90th meridian time, 12 noon; one hour in time equals 15 deg.; 90 — 88½ is equal to 1½ deg.; 1½ deg. of longitude equals 6 min. time; therefore, mean solar time equals 12:06 p.m.; equation of time to be added for Nov. 1, 1908, taken from solar ephemeris equals 16 min. 19 sec.; therefore, apparent solar time is equal to 12 hours, 22 min., 19 sec.; therefore, if the shadow of the gnomon is placed at 22 min. and 19 sec. past 12, the sight standards will be in a true north-south plane.

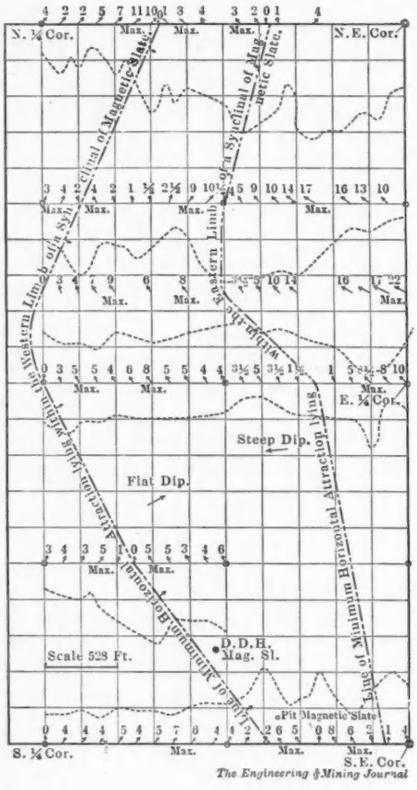
The errors to which observations with this instrument are liable are due, first, to the use of an instrument whose hour circle is not graduated for the latitude of the place of observation; second, errors due to poor watches and incorrect calculations of time; and third, errors due to the fact that the gnomon is not adjusted on the instrument to the angle of the latitude.

In regard to the second error it is suggested that when a new camp is pitched and the watches are correct it is well to set up the instrument and place two stakes accurately on the north-south line, then each morning before taking the instrument into the field the watches can be set by orientating the instrument on the stakes and observing the shadow on the dial. This gives a handy method of correcting the watches each day and insures accurate time.

The third error is a much more serious one. It is due to imperfections in the manufacture of the instrument. The vertical standards are made so that they fold when packed. The hinges on these standards are so imperfect that it is difficult to be sure that the standard to which the gnomon is attached is truly vertical when raised. In case it is not the angle that the string makes with the horizontal will not be equal to the angle of the latitude and a serious error will be introduced. To overcome this error the observer should make a triangle of cardboard with one angle equal to the latitude. The angle of the gnomen can then be tested, at any time in the field, with this triangle. In case the instrument were made with a screw adjustment this error could be corrected at any time.

Surveying with the Sun-dial Compass

In making the observations with a sun-dial compass it is customary to run north-south or east-west lines from the government subdivision points. These lines are run as close together as the character of the work justifies. The usual practice is to run them not more than one-eighth of a mile apart, that is, one between every sixteenth post. The normal magnetic variation is set off on the instrument by means of a vernier provided on the compass. At regular intervals, say at one hundred paces or less on these north-south, or east-west lines, the instrument is set up and orientated and the magnetic variation is recorded. In connection with the reading of the horizontal needle at these stations, dip-needle readings are taken as will be explained later. It is also customary to make a detailed geological study of the country passed over at the same time, outcrops being located with reference to the line run with the compass. When in a magnetic country the strike of the rocks should be taken by means of the sun dial also. Trained woodsmen are employed to run the compass and the limit of error of 1 in 100 or 20 paces to the mile is common in this class of work.


N. ¼ Cor.
N.E. Cor.
Max.
Western Limb of Synclinal of Magnetic Slate
Eastern Limb of Synclinal of Magnetic Slate
Steep Dip.
Flat Dip.
Line of Minimum Horizontal Attraction
Line of Maximum Horizontal Attraction Making Right Angles with Line of Minimum Horizontal Attraction
E. ¼ Cor.
D.D.H. Mag. Sl.
Scale 528 Ft.
Pit Magnetic Slate
S. ¼ Cor.
S.E. Cor.
The Engineering & Mining Journal

A Magnetic Survey Map

The dip needle is an instrument used to observe the vertical component of a magnetic field. There are two types in general use; the Norwegian needle, in which the magnet is pivoted on a universal joint so that it assumes the direction of the magnetic field; and the other type in which it is fixed rigidly in one plane which permits of only a vertical deflection. The fixed-needle instrument is found to work much more satisfactorily than the Norwegian needle because it is more sensitive and the bearings do not get out of order so quickly. In using the observer must orientate it into the plane of the horizontal needle at the station of observation. The needle of the dip needle is weighted on the south end with a piece of wire to overcome the moment of the normal magnetic field. This wire can be adjusted so that the needle will read zero in a region of no local attraction. However, it is difficult to keep the needle at this adjustment so it is more practical to record a constant error. In the rough field work incident to magnetic observation the bearings of the dip needle are apt to be injured. Constant care and attention are necessary to insure accurate reading with this instrument. It is good practice to have two or more needles in the same party. Frequent comparisons of readings over the same station will indicate whether they are working accurately. The writer has had occasion to use as many as three different needles during the same season's field work. The novice with this instrument is very apt to get a set of observations of absolutely no value.

Recording Magnetic Work

The easiest method of mapping and recording magnetic work is on square cross-section paper 20 in. wide ruled with 10 divisions per inch. The work is usually mapped by sections and the outcrop plotted on the same map. A convenient scale with the cross-section paper is 20 in. equal to one mile. In the field the trained woodsman is accustomed to pace 20 tallies or 2000 paces to the mile. In case his natural stride does not agree with this length of pace he corrects it at the end of each tally. On the above scale one tally is equal to 1 in. and one small division on the paper or 1/10 in. equals ten paces.

The readings of the horizontal needle are entered on the map at the stations where they are observed, with an arrow indicating whether they are east or west of north. The dip-needle readings are plotted in the form of a curve from the north-south or east-west line of that traversed as a base and each degree of dip is plotted equal to one small division on the cross-section paper. The accompanying map in which only each tenth cross-section line has been reproduced shows this form of plotting. When completed the map is in such shape as to permit making deductions as to location and structure of magnetic rocks as well as geological inferences from outcrops. In working with these maps a special scale can be purchased divided with 1 in. equal to 264 ft. so that distances can be scaled directly from the map.

In the field a convenient note book is the engineer's cross-section note book, 6½x8½ in. in size, with rulings of cross-section paper the same as has been described. Each page of the book is large enough to cover five large squares each way, and therefore will include a 40-acre tract with sufficient room at the bottom of the page for geological notes and speci-

men numbers. A convenient arrangement of the notes is to use the first two pages on the right- and left-hand sides of the open book as the northeast ¼ of the northeast ¼ and the northwest ¼ of the northwest ¼ respectively. The next two pages, the southeast ¼ of the northeast ¼ and the southwest ¼ of the northeast ¼, and so on through the other quarters of the section. This is a simple and logical arrangement of the note book.

Interpretation of Magnetic Readings

It is not the purpose of this paper to go into a mathematical discussion of the theory of the effects of the magnetic disturbance upon a horizontal, and a vertical needle. However, an attempt will be made to give a practical discussion of the phenomena and rules to guide in the proper intrepretation of them. This discussion is condensed from *Monograph* 36 of the U. S. Geological Survey on the Crystal Falls iron-bearing district.

As has been indicated the formations to be explored are either sedimentary or a more or less regular contact of sediments with intrusives. This results in the localization of the magnetism in the form of long narrow bands more or less steeply inclined.

The magnetism in these bands is due to induction by the earth's field. Therefore, negative or south pole polarity is uniformly found at the outcrop. While the north pole, considering the rocks as magnets, is located at an indefinite distance below the surface out of reach of influence upon the compass or dip needle. A magnetic formation can, therefore, be considered as a solid sheet magnet with the south pole uppermost. In magnetic work the lines are run north and south or east and west, whichever direction cuts the formation at the greatest angle.

The vertical and horizontal components of the magnetism in rock strata combined with the vertical and horizontal components of the earth's magnetic field determine the resultant forces acting on the vertical, and horizontal needles. The earth's magnetism is approximately constant.

The magnetic force of a given magnetic band varies inversely with the square of the distance of the instrument from the seat of the magnetism in the band. In general this force is dependent upon the thickness of the overburden and the distance of the instrument from the formation.

In discussing the phenomena observed in the readings of the horizontal and vertical needles, the following cases will be discussed: (1) Magnetic formation with vertical dip; (2) magnetic formation dipping at any angle and with strike inclined at any angle to the north; (3) the special case of the magnetic rocks striking due east; (4) parallel magnetic formations.

Vertical Magnetic Formation

Let us consider under this head a magnetic formation with a vertical dip, a width of $2A$ and a depth to cover equal to H. In approaching such a formation from the east, on an east-west traverse, the horizontal needle will first show a westward deflection, increasing with the approach to the formation and reaching a maximum near the east edge of the belt. It will then begin to decrease and reach zero at the center of the belt, increasing with an eastward deflection to an east maximum near the west edge of the formation and thence decreasing to normal, outside of the reach of the magnetic formation. If X represents the distance of the maximum points from the center of the formation it can be shown that: $X^2 = H^2 + A^2$. The relative amount of deflection at the east and west maxima will depend upon the direction of the strike of the rocks. When the strike is north these two maxima will be equal. When it strikes east of north the western maximum is the greater. When striking west of north the reverse is the case.

With an east-west traverse approaching the formation from the east the vertical needle will start with a constant error outside of the range of magnetic influence of the rock and increase gradually through a maximum at a point within the formation, passing westward it will again decrease to zero. The point of maximum deflection in a formation with a north strike will be in the center. With a formation, the strike of which is inclined at an angle to the north, the maximum deflection will be reached at a point that lies on the side of the formation making an obtuse angle with the east-west traverse.

As in the case of the horizontal needle, it is also found with the dip needle that the dip curve, or curve representing the respective readings of the dip needle, will not be symmetrical in approaching a formation with other than a north strike. When the formation strikes east of north the western dips are greater or the dip curve will be steeper on the east side, or generally speaking, stations on the side of the formation on which the east-west line of traverse make an obtuse angle, show the greater dips. These conclusions are only true for vertical formations.

Magnetic Formation of Any Dip

In formations dipping at moderate to low angles the assumption that the north pole of magnetism is out of reach of the needles is not warranted. The influence of the bottom pole is to decrease the force acting upon the needle at any point. The following general conclusions can be demonstrated mathematically and have been observed in the field with regard to behavior of the vertical and horizontal needles under these conditions of dip of formation: (1) The direction of dip of the magnetic formation is toward the nearer of the two maxima to the point of zero horizontal deflection. (2) The point of no deflection of the horizontal needle is not over the center of formation, but lies nearer the dip side. (3) In rocks with slight dips the horizontal maxima are not so pronounced and irregularities in the behavior of the needle are observed. (4) The dip needle shows a maximum value near the zero of the horizontal needle only where the rocks are steeply inclined. In case of flat dipping rocks, the vertical needle is apt to show, on the side opposite the dip side, a wide zone of readings which are less than normal.

Magnetic Rocks Striking Due East

The prevailing strike of a large number of the iron-bearing rocks of the Lake Superior region is east, so that the special case of the behavior of the vertical and horizontal needle with such rocks is of importance.

In prospecting such a formation the traverse should be run north and south. In approaching the belt from the south it will be readily seen that the horizontal needle will give but little indication of its presence, inasmuch as the magnetism of the rocks acts in the same direction as that of the earth, therefore, no southern maximum will be observed. After passing the magnetic belt the magnetism of the earth and the magnetism of the rocks will act in opposite direction, and when that of the rocks exceeds that of the earth, the direction of the needle will be completely reversed, and the north end will point south. Farther north the earth's magnetism will counterbalance the local magnetism and the needle will again swing around into the meridian. It generally happens, however, especially when the rocks are not overlain by deep cover of drift, that the irregular distribution of the magnetism on their surface will produce other deflections than those described. They will be haphazard and will not indicate magnetic maxima.

The dip-needle readings for an east striking formation with a considerable covering of drift is as follows: Starting with a reading of constant error at a considerable distance from the formation, in moving northward the readings increase slowly to a point north of the center of the formation where they reach a maximum. Then they decrease until they reach a normal condition north of the influence of the magnetism of the rocks. The reading north of the maximum will uniformly show higher value than corresponding points to the south, that is, the dip curve has a steeper slope south of the maximum than north. It often happens that readings less than normal will be observed south of the magnetic belt. This is due to the fact that the rocks have a very small covering and the hori-

zontal magnetic forces are so strong that they counteract the vertical component.

Parallel Magnetic Formations

In the previous discussion only one belt of magnetism has been considered. It often happens that two belts of magnetic formation lie so close together that their magnetism combines to produce a different set of phenomena. This is the case where there are two distinct magnetic formations in the same series of rocks.

It more often happens that the same magnetic belt has been repeated by close folding or faulting or by intrusion of a narrow eruptive producing the phenomena of parallel formations. The proper interpretation of the phenomena is of importance in working out the structure of the rock and especially in the detection of synclinal folds where the presence of orebodies is probable. Under this heading will be discussed, first, formations parallel and with a vertical dip; second, parallel formations dipping at equal angles in the same direction; third, parallel formations dipping toward each other, and, fourth, parallel formations dipping away from each other.

In formations with a vertical dip, or in fact with any parallel formations, the phenomena vary widely with the distance between the magnetic formations and with the depth of surface covering. In general it can be said that formations with a vertical dip will show three points of minimum horizontal readings with three corresponding maxima. One of the horizontal minima will be midway between two formations and the other will be at the outer edges of the magnetic belts. As the depth of cover increases the minima and maxima will grow less distinct and finally merge into one point of minimum deflection midway between the two formations and two maxima at the outer edges of the two belts. The vertical needle will show two points of maximum deflection opposite the center of each magnetic formation.

Formations Dipping in the Same and Opposite Directions

In the case of formations both dipping in the same direction at the same angle, the horizontal needle will usually show three minima, one between the formations and the other two on the dip side of each belt. The vertical needle as a rule will show two maximum points of deflection, one on the dip side of each formation.

When the formations dip toward each other there is an infinite variety of phenomena, depending on the relative dips of each formation and the depth of cover. There will usually be indications of horizontal minimum values at three places with corresponding maxima. One of the minima will be between the two formations, the other two being on the dip side of each formation. The side of the two outside maxima indicate the steepness of the dips of the respective formation; the formation with the steeper angle of dip having the larger maximum. In the same way the vertical needle shows two maximum values, one over each formation, the greater maximum over the steeper. It will be readily seen that the above condition of dips of formation will arise from the structure of the syncline.

In the case of two formations dipping in opposite directions which will arise in the structure of an anticline, the distance apart of the two formations, i.e., how deeply the anticline has been truncated, is the determining factor in the character of the readings. When the legs are separated by considerable erosion the phenomena indicate two formations and their respective dips.

There is a central horizontal minimum between the formations and two minima on the dip side of each limb. The dip curve shows two maxima, one on the dip side of each formation. In case the formation has been but slightly eroded, i.e., the legs are close together, the phenomena will indicate one vertical magnetic belt.

The Pitch of Anticlinal and Synclinal Axes

It is universally true, in the iron-bearing rocks of this district, that the axes of synclines and anticlines do not continue horizontally for any length of time, but pitch at more or less steeply-inclined angles. It is, therefore, found that the magnetic phenomena of parallel belts will not continue long in the direction of the strike in such a fold. In working toward the outcrop of the axis of the syncline, the belts will come closer and closer together until finally the end of the formation is reached, beyond which, magnetic phenomena disappear entirely. In working toward this outcrop it will also be found that the direction of the magnetic force of the rock will no longer act at right angles to the strike, but will be inclined in the direction of the pitch of the axis.

In working toward the pitch of an anticlinal axis the belts approach each other as the formation gets deeper and deeper. Finally they will join and continue as one magnetic belt which will grow weaker until finally the rocks are so deeply covered that their magnetic force will not influence the needles at all.

In the case of a formation split by an intrusive, the shape of the intrusive, i.e., the dips of the sides of the contact, will govern the character of the magnetic action. As we pass along the strike of such a formation we will finally come to a point where the intrusion pinches out. This will usually happen abruptly. The magnetic belt will then continue as one formation.

An Illustrative Example

As an example of the method of plotting described above and of the character of readings secured in an actual survey, a half-section map is shown in the illustration. The formation consists of a magnetic slate in intimate relation with the iron formation as its footwall. The heavy dotted lines represent the points of minimum horizontal attraction, or the strike of the magnetic formation. It will be noted that there is another zone of minimum attraction lying between these lines. The magnetic phenomena in this case agree with those explained above for the structure of a syncline. The two lines of minimum attraction represent the outcrops of the limbs and the third zone is formed, as would be expected, between them. The deductions as to the dips of the respective limbs are shown on the map. The readings shown on this map are only such as were actually taken in the field. They illustrate the extent to which magnetic work is applicable in deciphering structure of magnetic rocks which are deeply buried.

The above discussion may seem to the average user of sun-dial and dip-needle as merely theoretical and the results described unattainable in practice, due to the many disturbing influences, and the inaccuracies of the instruments. However, careless work has been the rule with these instruments and the fact that more useful information has not been acquired is due more to this cause than to the inadequacies of the instruments. As has been demonstrated by the U. S. Geological Survey and by some of the more scientific field parties, which have not only located magnetic contacts, but also interpreted structural features by their use, careful work will produce results which are of inestimable value in the economic development of ore deposits which are deeply covered by an overburden of drift.

Mason & Barry, Ltd.

Mason & Barry, Ltd., operating the San Domingos Mine in Portugal, have presented a report for the year ended Dec. 31, 1910. Ore broken and raised from the mine in 1910 amounted to 360,406 tons, and the profit from 1910 operations was £73,850 or 4s. 1d. profit per ton of ore mined. Unfortunately no details as to ore tenor, extraction, or detail working costs are given. A wet process is used much on the line of the Rio Tinto. Mason & Barry has been a decided success; since 1892 the value of the shares has been reduced by paying back £4 on each £5 share and dividends amounting to £5 19s. have been paid. The balance sheet is ultra-conservative; for instance, there is no value attached to their mine, and of the entire assets of £303,472, at least £251,000 and possibly £269,000 may be regarded as liquid.

Calumet & Hecla Milling Process

By Howard G. Wright *

This company mills 8000 tons per day. The rock is crushed by breakers of the Blake type at the mine to 3½ in. and then by Leavitt simple steam stamps; crushing and lifting pistons of different diameters. Jigs, Wilfleys, Evans and Calumet tables used for concentrating.

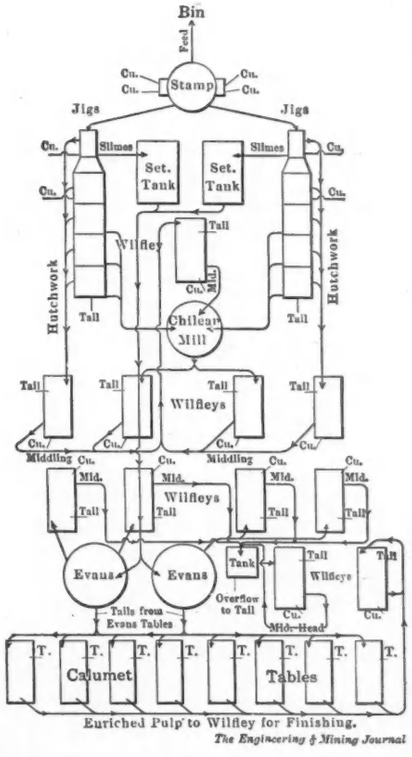
*Mining engineer, Lake Linden, Mich.

The Calumet & Hecla mills are situated on Torch lake, Mich., about five miles from the mines. There are two separate mills: the Calumet, consisting of 11 sections; and the Hecla, consisting of 17 sections. The total capacity of the two mills, when working on conglomerate, is about 8000 tons per 24 hours, an average of about 300 tons per section. The treatment of the hard conglomerate rock is practically the same throughout the two mills and only one section will be described in this article. The rock, known as the Calumet & Hecla conglomerate, carries native copper and silver in a gangue of rhyolite conglomerate with a little calcite, epidote and martite.

As the rock comes from the shaft, it is put over 3½-in. grizzlies, the undersize falling into bins and the oversize going to Blake-type crushers. These crushers vary in size up to 24x48 in. and all break to 3½ in. Both undersize and crushed material are then sent to the stamp mills at Torch lake over the company's own railroad. At the mills, the rock is dumped into flat-bottom bins of 1000 tons capacity. The rock in the bin is delivered, by means of a chute, to a reciprocating feeder 3x7½ ft., making 65 strokes per min. The mass or chunk copper is picked by hand from this feed by the head feeder and thrown into a box for "mineral." Any wood in the rock is also picked out by the head feeder, thus to a large extent relieving the clogging of screens by wood. The reciprocating feeder delivers the rock into the mortar of the steam stamp, where it receives its first crushing in the mill.

Leavitt Steam Stamp

The Leavitt simple steam stamp is used, which was designed to effect economy in steam consumption over the ordinary simple head. The stamp has two pistons; the upper or larger piston which is 21½ in. in diameter receives the steam pressure for the down stroke and the lower piston raises the stamp. The steam for the down stroke is admitted over the large piston at a pressure of about 115 lb. per sq.in. for about 40 per cent. of the down stroke and the rest of the stroke is made on the steam expansion. The valves are of the slide-griddle type and are actuated by means of cams, with adjustable cutoffs. The valve motion is driven by power from an independent source. The steam under the lower piston for the return stroke is held at a nearly constant pressure by means of a regulator which admits steam when the pressure falls below 50 lb. The down stroke is always made against this nearly constant pressure in the lower cylinder. The shoes used are made of hard iron and weigh about 700 lb. The rock as it is fed into the mortar drops on the die upon which the blow is made.



Calumet & Hecla Flow Sheet

The mortar has grates on all four sides, perforated with 3/16-in. round holes. The copper which remains inside the mortar, over 3/16 in. in size, is cleaned by means of two "mortar jigs" on opposite sides of the mortar. These jigs consist of 1½x12-in. slots at the base of the grate frames, opening down into chambers 4x12-in. which are provided in their bottoms with screens having 1-in. openings. These screens lie over larger compartments which are divided by double sets of valves equipped so that the clean hutch, coarser copper on top of screen and the tailing can be discharged separately without in any way affecting the work going on inside the mortar. One plunger, 8 in. in diameter, making 195 two-inch strokes per min., furnishes the pulsation for each jig. The hutchwork and the oversize work are ready for the mineral car. The tailing, together with a mortar cleanup, which is made every four days, is cleaned on a one-compartment Woodbury-Benedict jig. A concentrate is made on this jig and the tailing from the cleanup goes back to the mortar. One of these jigs is provided for each 11 heads.

Stamped Material Goes to Classifiers

The crushed material which goes through the 3/16-in. grates forms a pulp, about 40 per cent. of which is slime. This pulp is delivered through launders to Woodbury-Benedict slime classifiers arranged in two units. These machines are equipped with 10-mesh screens, 24x36 in., in the line of treatment. The plungers are 12x24 in. and give a pulsation parallel to the flow of the feed. They run at a speed of 195 r.p.m. with a ⅞-in. stroke. These machines separate the slime by means of a U-shaped shield supported so that the bottom rests in the sand bed on the sieve. The slime, being unable to work through the sand under the shield, flows around and is delivered through launders to settling tanks. Continuous discharge of copper is made on these machines by means of concentrate cups supported over the screens so that the bottoms of the cups rest in the mineral bed. A hutchwork is made which is given further treatment and the tailing is delivered to two units of Woodbury-Benedict jigs consisting of four jigs each.

These jigs are equipped with 30x50-in. screens and 12x50-in. plungers, running at a speed of 195 r.p.m. The first jig of each unit has a ¾-in. plunger stroke and a 10-mesh screen. A copper concentrate is made on these machines from two cups on top of each screen, a hutchwork which receives further treatment, and a tail which is delivered to the three succeeding jigs. The second, third and fourth jigs of each unit are all equipped with 12-mesh screens and operate at 195 r.p.m. with plunger strokes ranging from ⅝ in. down to ⅜ in. A middling is taken off these six jigs by means of a hydraulic middling discharge at the tail end of each jig. The hutchwork from the slime classifiers and from all eight jigs

is delivered over hydraulic boxes to two Wilfley tables. A copper concentrate is made on the hydraulic boxes and also on the Wilfley tables. The middling from the second, third and fourth jigs of each unit is delivered to a 6-ft. C. & H. chilean mill, where it is ground to pass through 16-mesh diagonal needle-slot grates. This pulp is treated on two Wilfleys and a concentrate made. The middling from these two Wilfleys, together with the middling from the two tables treating the hutchwork from the jigs, is again treated on a Wilfley where a copper concentrate is made and a middling which is delivered back to the chilean mill. The tailing from the fourth jig of each unit and from the Wilfley tables is discarded, with the exception of the richer tailing from the fourth jigs and hutch tables, which is given further treatment in the regrinding plant. The slime from the slime classifiers is delivered to two 5x9-ft. settling tanks handling 125 tons of slime every 24 hours. The thickened pulp from these two tanks is treated on two Evans revolving round tables of four decks each. These tables are 16 ft. in diameter, making one revolution in 57 sec. with a capacity of about 16 tons per 24 hours.

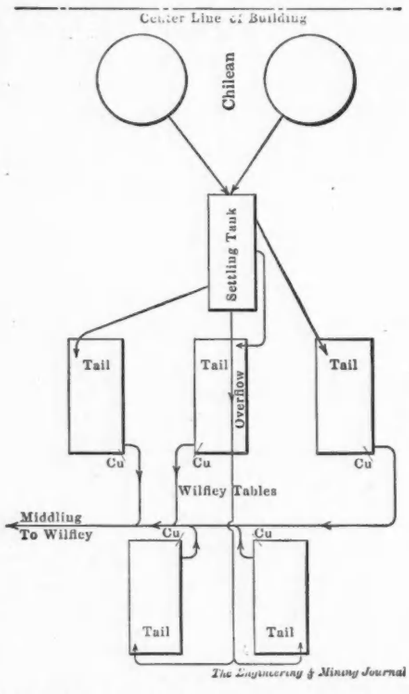
Evans Tables Have Concrete Surface

The decks of the Evans' tables have a slope of 1½ in. per ft. and are surfaced with cement grouting. These round tables deliver an enriched pulp to four Wilfley tables. Each Wilfley table makes a finished concentrate, a middling and a discarded tailing. The middling from these four tables is pumped up to a tank from which a Wilfley table is fed. This middling table makes a finished concentrate, a middling which goes back to the tank and a tailing which is discarded. Since the Evans round tables were installed, eight Calumet tables have been erected to handle the tailing from the Evans tables. The Calumet tables are similar to the Wilfley, except that the riffles end in a straight line at right angles to the line of motion about 30 in. back from the end of the deck. An enriched pulp is made on these Calumet tables and the pulp from 16 treated on one Wilfley. A finished concentrate is made on this Wilfley, a middling which is returned to the table and a tailing which is discarded. The amount of silver in the rock is small and no attempt to separate it from the copper is made in the mills.

About 30 h.p. is used to operate each section, and about 1,250,000 gal. of water per day in the washing. The mills are operated in independent units by means of electric motors. The mass copper picked by the head feeder is loaded into the mineral cars by means of chutes from the head-feeder's floor to the mineral track, which runs the width of the building between the jig and table floors. The copper from the mortars and jigs is loaded by means of shakers. The shaker is a steel trough extending from the mineral track back to a point convenient to the concentrate discharges on the jigs and the mortar. A shaking motion is given the trough by means of belt-driven disk differentials, which shake the copper through the trough into the mineral car. The fine-table copper is pumped by means of centrifugal pumps to dewatering boxes supported high enough above the floor to load a mineral car with the dewatered mineral from spigots.

The Regrinding Plant

The regrinding plant was recently completed and is treating about 1400 tons of conglomerate tailing per 24 hours. The building is 123x346 ft., constructed of steel with concrete floors and foundations throughout. The plant is arranged in eight sections, each containing six chilean mills, 17 Wilfley tables and three classifying tanks. The power for each section is furnished by one 250-h.p. induction motor. The material treated is the richer tailing from the Wilfley tables which treat the jig hutchwork, and the Woodbury-Benedict jigs. This material is delivered into and through the building in two launders at a hight great enough to give the necessary head for the subsequent treatment. The 6-ft. chilean mills are arranged in two rows with an avenue between, which is on the longest center line of the building. The feed at each mill is regulated by means of a hinged gate in the launder. The mills are equipped with 20-mesh, needle-slot grates. The pulp from two chilean mills is delivered to one 3-spigot classifying tank.



One Half of C. & H. Regrinding Mill

These tanks are 3½x9 ft. and are arranged in three compartments. The feed comes in at one end, giving the first spigot the coarser pulp, the second spigot a medium size and the third gets the fine. Each spigot feeds one Wilfley table and any overflow which comes from the classifying tank is treated on two Wilfleys. The middling from 15 tables is treated on two Wilfleys, the middling from here going back to the same tables. An Allis-Chalmers tube mill and also a Hardinge conical pebble mill are being tested out in this plant as a substitute for the chilean mill. The tailing from the two main mills and also from the regrinding plant is elevated by means of sand wheels to allow enough fall in the launders for dumping it into Torch lake. There are five sand wheels in all, two 50-ft. diameter wheels for the Calumet mill and the regrinding plant and one 40-ft., one 50-ft. and one 60-ft. wheel for the Hecla mill, all electrically driven.

The water for the three mills is furnished by four steam-driven plunger pumps and comes from Torch lake. The four pumps have capacities as follows: The Michigan 60,000,000 gal. per 24 hours, and the Arcadian, Huron and Ontario 20,000,000 gal. each. An I. P. Morris centrifugal pump of 60,000,000 gal. capacity per 24 hours is being installed as an auxiliary for the pumping plant.

Power Plant

The 10,000-h.p. boiler plant is equipped throughout with Babcock & Wilcox boilers furnished with automatic stokers. The electric-power plant consists of three 2000-kw. General Electric generators direct connected to three Leavitt three-cylinder compound engines running at a speed of 107 r.p.m. and furnishing current at 13,200 volts; one 1000-kw. General Electric generator direct connected to an Allis-Chalmers twin steeple-compound engine, and one 1000-kw. General Electric generator driven with a rope drive by a Leavitt triple-expansion engine, both furnishing current at 440 volts. This power is used throughout the mills and part of it is transmitted to the mine at 13,200 volts and stepped down to 2300 volts for use there.

Alkali Proof Portland Cement

It is claimed that the durability of the old cements, for instance, those of the Romans, was due to a low proportion of soluble silicates and a low lime content, under 50 per cent., and that most modern high-lime cements are deficient in resisting power when exposed to waters containing dissolved alkalis and sulphates. The Colorado Portland Cement Company, of Denver, Colo., has begun the manufacture of a cement which, it is claimed will resist alkalis and sulphates, by virtue of a low lime content, and an excess of silica, using limestone, shale, and blast-furnace cinder as raw materials.

Ore Reduction in the Harz—II

By O. H. Hahn *

The smelteries of Clausthal, Lautenthal, St. Andreasburg and Altenau are described. These last two smelteries are to be closed permanently on April 1, 1912.

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Following the course of Innerste creek from Langelsheim up into the mountains, a branch of the main railroad leads through a densely wooded country, which is only bare where the exploitation of mines and quarries has been instrumental in creating large dumps of waste rock, to the tableland of Clausthal-Zellerfeld. Geologically, this tableland belongs to the lower Carboniferous era and has been fissured extensively during a later epoch. The fissures run more or less parallel west of northwest, obliquely against the strike of the stratification, and dip steeply toward the southwest. A dip to the northeast is exceptional, but does occur. Most of the fissures are filled with fragments of country rock and with quartz, barite or calcite, and carry lead, zinc and copper in sufficient quantity to render their exploitation profitable. Veins running for some distance in close proximity, sometimes joining each other at one end or both and then continuing as one lode are locally called *gangzug* (line or group of veins).

Clausthal Lode 130 Feet Thick

In the Clausthal district 10 of these lines of veins are distinguished. The thickness of the individual veins is hard to determine as only their foot-wall is well defined while the country rock toward the hanging-wall is shattered so much that the ore is scattered through it for some distance. Hence figures like 100 or 130 ft. given by interested persons as the thickness of a lode are not considered to be out of the way. Nor does the thickness appear to diminish as depth is attained. The predominant ore is galena carrying from 3 to 90 oz. of silver per ton; the next in importance is sphalerite which is especially prominent in the mines near Lautenthal; the occurrence of copper pyrites is insignificant. The prevailing gangue is quartz as such or as graywacke; so called *gangtonschiefer* (vein clay-slate), a soft, crushed slate of a dark black, lustrous color easily distinguished from the clay-slate forming the country rock; subordinately calcite, and in the southwestern part of the district, notably near Grund, a profusion of barite is an unwelcome concomitant in the subsequent concentration.

Drainage Tunnel Used as Canal

The veins are developed through numerous shafts; most of the old ones have been abandoned, however, on account of their irregular shape which rendered their operation and maintenance expensive. The southeastern part of the lines of veins seems to have been worked out as I saw all the shafts and dressing works in that region, including the comparatively new "Königin Marien Schacht," idle and in the course of being dismantled. In the days when machinery was imperfect and costly, long drainage tunnels were driven to unwater the mines, two of which are remarkable for their great length, to wit: (1) The "Tiefe Georgstollen" measuring 20,500 m. or about 12.73 English statute miles in length. It has its mouth near Grund; (2) the "Ernst August Stollen" measuring 26,000 m., or about 16.15 statute miles in length. It has its mouth near Gittelde, a station on the Herzberg-Seesen railway line and, although still 600 ft. above the level of the North Sea, is the deepest point at which a drainage tunnel could be started. It took 13 years to build, but it has, like the Sutro tunnel, in America, long ago ceased to be the deepest level in the mines. Hydraulic engines and pumps set up underground are now raising the water to the tunnel level. In the mines part of the tunnel is made navigable to facilitate the transportation of the ore to the dressing works nearest to the reduction works.

Extensive Water System

The necessity of concentrating the ores before they can be profitably smelted has given rise to the establishment of an extensive system of water supply which at the same time affords power for driving numerous water wheels, turbines and hydraulic engines in use at the mines, ore-dressing and reduction works. The water is brought in ditches from the moors and bogs of Mt. Brocken and Bruchberg in which the head waters of Innerste and Oker creeks and a multitude of smaller mountain streams also originate. No less than 67 storage ponds with a capacity of 335,500,000 cu.ft. serve to distribute the water to the different mines and works. Nevertheless, owing to altered conditions, steam, compressed air and the electric current have also found room for judicious employment.

There are dressing works in each division and subdivision of the administrative district of Clausthal, but in accord with the present policy of centralization and retrenchment inaugurated by the Prussian government, all the small and antiquated ones have been abandoned. Hand dressing plays an important part in ore concentration on the Harz, particularly with regard to the elimination of barite and in a minor degree to sphalerite. In the newer dressing works special provisions have been made for the separation and saving of the latter. The lead concentrates average 72 per cent. in lead and from 18 to 21 oz. in silver; the zinc concentrates from 48 to 49 per cent. in zinc. The first-class lead ore (*stufferz*) obtained by hand dressing is higher in silver. An analysis made 15 years ago gave the average composition of all the ores put on the charge floor as follows: Pb, 65 per cent.; Zn, 5; Cu, 0.4; Ag, 0.1 (29.16 oz. per ton); SiO_2, 10 per cent.

Clausthal Works

The zinc concentrates are sold to private smelteries, while the lead and copper concentrates are reduced at the government's own works, the former at the Clausthal smeltery, the latter at Altenau. The Clausthal works, the real name of which is Frankenscharrnerhütte, is situated in a depression at the junction of Clausthal and Innerste cañons, two miles from town, on the line of the railway and is connected with the new dressing works adjoining the Ottiliac main hoisting shaft by a tramway over which the ore is received. The foundation of the smeltery dates back to 1554. Naturally many additions and alterations have been made during these 356 years of its existence. The changes effected since my first visit in 1860, while a student at Clausthal, and later on in 1889 and 1910 revealed to me the fact that progress has assumed a livelier gait during the last 20 years.

In the blast-furnace building I saw four round furnaces running, three on an ore charge and one on by-products. The furnaces are similar to those at Oker, having five tuyeres and the same hight, to wit, 16 ft. 4 in. The only difference is that they are operated with a closed front. In the same building there are two circular rotating furnaces of the Huntington-Heberlein type and 11 of their converters, 10 of which are constantly kept in operation while one is being charged. In breaking up the agglomerate from the converters there is a good deal of fine stuff produced, which is separated by screening and added to a new converter charge. The small quantity of matte produced is accumulated and kept exposed to the weather, when it will crack and fall to pieces. This weathered matte is then pulverized in a ball mill and treated by the Huntington-Heberlein process like the ore. On the

charge floor I noticed that the ore charge was made up of agglomerated ore, spent pyrites, iron-refinery slag and foul slag.

By-product Treatment

The by-product charge was made up of wetted flue dust, slaked lime and unroasted furnace barrings. This is a departure in the direction of economy as formerly the flue dust was carefully mixed with pulverized clay slate and made into bricks which were air-dried on boards laid across the stringers above the charge floor. The furnaces put through 33 charges of smelting mixture of 1200 lb. equal to 39.6 tons in 24 hours with 10.7 per cent. coke. The charge for the H.-H. process is also made up on the charge floor by mixing the *schlichs* with the proper proportion of lime and sand, dumped into the hoppers above the roasting furnaces.

working. The bullion is shipped to Lautenthal by rail for further treatment.

In an adjoining building I caught a glimpse of the old Kast furnaces, a variety of the Pilz adapted to Harz conditions, standing idle in gloomy silence. The Raschettes are all wiped out of existence although their friends still claim great advantages for them, one of which is that they make a cleaner slag than the circular furnaces. I cannot see why they should. If the charge has been computed properly, if the proper amount of coke and blast are apportioned and if the feeding is performed intelligently a round furnace should make as clean a slag as an oblong one. Tonnage is, of course, another matter. There is hardly any limit on that score to the rectangular furnace; to the round one there is.

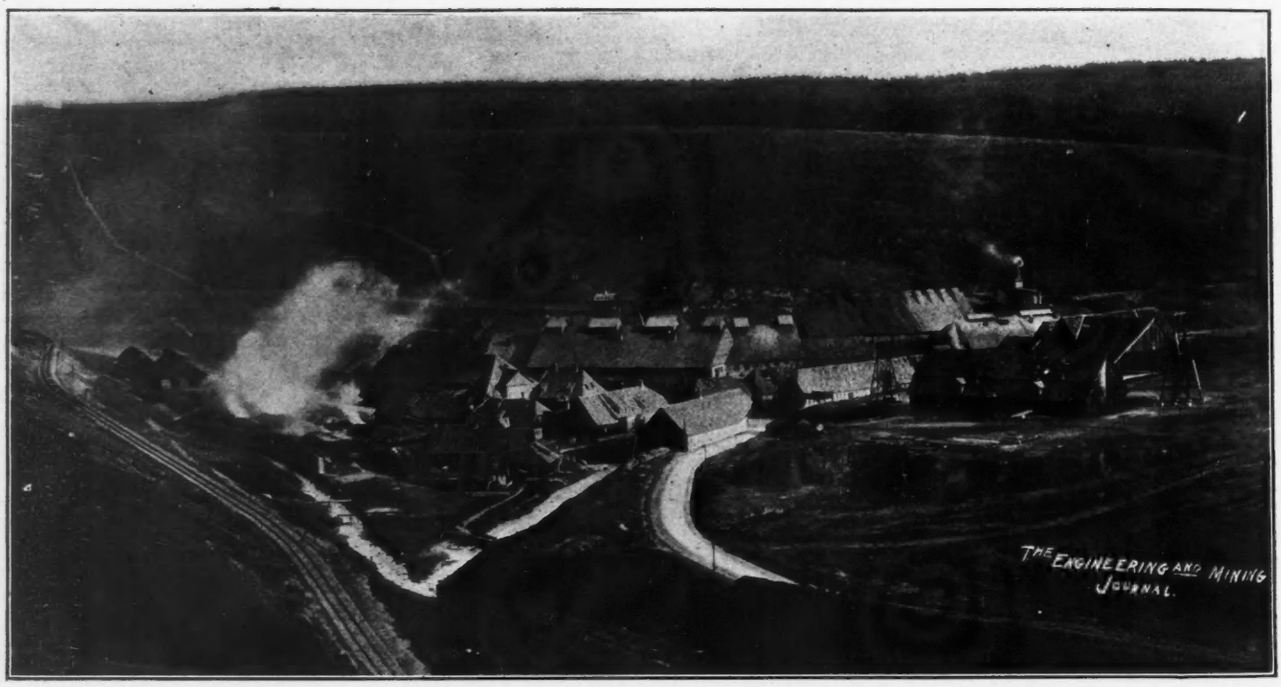
The arrangements for recovering the flue dust are about the same as at Oker;

Blast is produced by two blowing engines with three cylinders each, which were in operation 50 years ago, and one with one cylinder and a receiver for cases of emergency. For crushing furnace refuse, clay-slate and brasque, there are in use three stamp mills with a total of 15 stamps, of ancient construction. The works are electrically lighted.

All the machinery is moved by water power serving five overshot wheels and a Jonval turbine, with the exception of the single-cylinder blowing engine, which is coupled to a steam engine and is only used when water is scarce.

Lautenthal Works

Seven miles below the Clausthal smelting works on the same line of railway are situated the Lautenthal smelting and refining works. I did not find any record of its foundation, but suppose that it is



Clausthal Smelting Works, Upper Harz, Germany

I watched the slag of the flue-dust charge running into a pot and recognized that it had all the features of what Mr. Eilers would call a correct slag, to wit, the symmetric flow, the acid drip, etc. It carried visible matte with it owing to the sulphur contents of the smelting material. In the good old times when lead commanded a high price they used to make, unintentionally, an incorrect slag carrying a large amount of lead and made an inferior building stone of it. This practice has now been discarded. The lead bullion is tapped in the old way into a cast-iron basin, although the Arents well might, on such heavy lead charges as are carried here, be used to advantage as at Friedrichshütte. The small amount of copper in the matte would certainly not interfere with its

the gases are drawn off the furnaces through central tubes connected with dust chambers. The latter lead to a flue that ascends the hill in 13 steps, instead of on an incline, and terminates in a brick stack.

Aerial Tramway to Remove Slag

As in most of the old smelting works no provision was made for removing the waste slag from the furnaces on a down-hill grade, so a Bleichert aërial ropeway had to be installed to carry it from the smeltery yard to a dump on a hill side. For raising the bullion and other material to a higher level convenient for loading on railway cars two water elevators of the type previously described are in use.

not inferior in age to Clausthal. It consists of three distinct plants: (1), The blast furnace; (2), the refinery; (3), the sulphuric-acid factory.

In the blast-furnace department there are: Two circular six-tuyere blast furnace 16 ft. 4 in. high; two blast furnaces of square section in the hearth and for a little way above the two tuyeres, which are in the back, circular above. One of these furnaces is used for the reduction of litharge from the cupelling furnace, and other by-products, the other one for concentrating roasted matte and smelting for black copper; one large circular furnace with eight tuyeres, 28 ft. 8 in. high, which is out of commission. The tuyeres are made of cast iron and cooled with water. The walls of one furnace inclose a worm tube in which water circu-

lates. This looks like a precursor of water jackets!

Clausthal to be Made the Sole Smeltery

The ore treated originates from the neighboring mines and from the Grund division, but it is intended to make the Clausthal works the center of smelting and ship all the lead ores there, while Lautenthal will confine its work to refining and turn out the finished products for the market. The small quantity of copper ore mined and the copper matte incidentally produced, will not be treated any more, but sold in the market. The ore is for the most part smelted raw, only part being roasted and slagged in a Freiberg long-hearth furnace. The capacity of the latter is small, being only three tons per 24 hours. I was led to believe that the Savelsburg process had been introduced here, but found neither this nor the H.-H. process had been tried. One thing struck me as being uncommon; the coke was fed through an iron cylinder suspended in the center of the furnace. It was claimed that by feeding in alternate layers the coke had the tendency to burn up without benefiting the charge. In consequence of this arrangement the waste gases are drawn off on the side of the furnace. The ore being silicious, roasted matte and the usual iron fluxes as well as limestone and slag are mixed with it.

The blast is supplied by an upright three-cylinder blast engine and one Enke and one Roots blower, both small, all moved by a waterwheel. If water is scarce there is a Corliss engine in reserve to take the place of the waterwheel. A turbine drives a ball mill and another waterwheel a stamp battery for crushing furnace refuse. A small engine drives the dynamo for the electric light.

Lead-refining Operations

The refinery is new and is built and run on American principles. The old refinery had been built for the Pattison process, which was later discarded and replaced by the Cordurié modification of the Parkes process. At the present time the bullion to be refined is charged into a softening furnace holding 40 tons. The furnace is not water-jacketed, but lined with firebrick and magnesite, hence with an acid and a basic lining. The bullion is melted and first (copper) dross drawn. Then blast is turned on at the fire-bridge side to oxidize antimony and arsenic when antimonial dross (*abstrich*) is formed and skimmed off. When the bullion is clean, it is tapped into one of two cast-iron pots holding 36 tons. It is now zinked three times to obtain copper-gold alloy, rich silver alloy and poor alloy. The first and second alloys are treated separately to the end, while the third alloy is used again in zinking. The stirring during the zinking operation is performed by a stirring machine actuated by an electric motor. The copper alloy is dried or liquated in a small pot between the two large pots, the second alloy is dried in one of two small pots at the side. The lead sweated out from the second alloy goes back to a new charge. The dry alloy is retorted in a Faber du Faur tilting furnace, of which there are two. The rich lead from the copper alloy is cupelled for doré bullion, if need be with the addition of more lead. The desilverized lead is siphoned off into a market pot and is poled by running a jet of cold water into the hot lead to oxidize the zinc, taking the precaution to cover up the pot with an iron hood. This last operation differs from that in vogue in the United States where the poor lead is refined or "calcined" as it was called in the West, in a water-jacketed reverberatory and then run off into the market pot to be cast into molds ready for the market.

The poor-lead dross is made into yellow paint. The drosses from the softening furnaces have to be liquated and are then treated further, the one for copper, the other for hard lead.

Refining Doré Bullion

Both the doré bullion and the silver bullion are refined on a test. The silver bullion is then ready for the market. The doré bullion is granulated in order to part it by means of concentrated sulphuric acid. The solution of silver sulphate is decanted into a lead-lined wooden tank and the silver precipitated by scrap iron. The solution of ferrous sulphate is put into crystallizing vats to get crystallized copperas, which is sold.

The silver precipitate is pressed in a hydraulic press and dried in a cast-iron retort, after which it is melted in graphite crucibles and cast into bars. The gold residue is washed out with sulphuric acid and then dissolved in aqua regia. From the solution the gold is precipitated by a solution of ferrous chloride. After pouring off the excess of solution the gold powder is dried, melted in a black-lead crucible and cast into bars, when it is also ready for the market. The copper products are shipped to Altenau for further treatment. It might be stated here that the gold content of the silver is due to the foreign ores purchased and smelted at St. Andreasberg and Altenau, which have to send their cupel silver to Lautenthal for refining. The total production of gold during a year is less than 1000 oz. The official organ of the Prussian mining department gives the gold production of the administrative district of Clausthal during 1910 as 57.52 kg. (1849.3 oz. Troy), but this includes the production of Oker, an unknown quantity, perhaps one-half of the above 57 kilograms.

The process for sulphuric acid is new. It consists of three lead chambers and a supplementary one with a cubic content of 1950 cu.m., or 68,835 cu.ft., one Glover tower and two Gay-Lussac towers; and six roasting kilns in which lead matte is roasted to furnish the sulphur dioxide. It turns out about 1400 tons of sulphuric acid of 50 deg. B. for sale and 26 tons of sodium sulphate as a by-product.

Altenau Works

The Altenau works is situated seven miles due east from Clausthal and nine miles south of Oker, in an isolated position and connected with both places by a good turnpike road. It was founded in 1612 and was originally supplied with lead ores from the eastern part of the Upper Harz vein systems. As these gave out or were insufficient to afford a steady supply, Altenau was made the center of copper smelting and refining and received all the copper ore produced by the mines of the Upper Harz in order to utilize the existing water power and plant and, what was more important to the government, to give employment to the resident working population on whom a town of several thousand inhabitants depends for support. To keep up the ore supply required for steady work it became necessary to purchase in addition, foreign smelting ores. This business proved, however, to be a losing operation, as might be expected in a place of small capacity and remote from the seaboard. So the government has finally concluded to pension off all the old hands and shut down the works for good on April 1, 1912.

At Altenau the first refinery on the Pattison plan was started and the first Raschette furnace on the Harz successfully inaugurated. Both are still in evidence; the Pattison process has, however, given way to the Cordurié modification of Parkes' desilverizing process long ago, only the plant being retained for the installation of the latter.

Scope of the Altenau Works

The present scope of work embraces the smelting of argentiferous lead and copper ore in blast furnaces, the manufacture of bluestone from impure copper and, in connection, the manufacture of sulphuric acid for works use from the roasting of matte, the electrolysis of refined copper, the desilverization of lead bullion by the zinc process and manufactured of refined lead, the cupelling of coppery-lead bullion for silver, and the production of hard lead. The apparatus in which these operations are performed consist of:

One Raschette furnace with eight tuyeres; one four-tuyere and three two-tuyere circular furnaces, all 16 ft. 4 in. high; four blast furnaces for copper, 11 ft. 5 in. high; two long-hearth roasting furnaces; two kilns with four shafts each and one with eight shafts; one lead-chamber system with two Gay-Lussac towers; two German cupelling furnaces; one

Spleissofen with granulating vat; one English copper-refining furnace; one battery of eight desilverizing pots; one bluestone factory with five steam boilers; one electrolytic plant and several stamp batteries as at Lautenthal. The motive power is principally derived from water wheels and turbines, steam being accessory in case of emergency.

St. Andreasberg

Separated by the Bruchberg chain of hills from the northern part of the Upper Harz there is the vein system of St. Andreasberg, which is entirely different from those of the Clausthal plateau, geologically as well as mineralogically. These veins occur in the Lower Devonian shales and are purely silver-ore veins with calcite gangue, while those of the Clausthal region are base-metal veins with prevailing quartzose gangue. The St. Andreasberg veins[1] are narrow, varying from a few inches to 18 in. in thickness, and are patchy. The country rock being quite solid, little timbering was required in the shafts and underground workings of the mines, nor did the water ever give much trouble. Nevertheless, the patchy character of the veins finally led to the closing down of the mines as the balance sheet was heavily against them. Upon the strength of the showing in the mines, the reduction works was erected, in the middle of the sixteenth century, at the foot of the hill, where the town of St. Andreasberg is situated. Owing to the unstable supply of lead ore other divisions of the Clausthal district had to help out, and of late years the works has been run as a custom smltery altogether. Lead ores are received from Australia, Morocco, Tunisia and even Peru, silver ores from Cobalt, Mexico and South America. As it cannot be the province of a government to compete with its subjects by engaging in a private industry like purchasing ores, it has wisely decided to stop the St. Andreasberg works too. The time for shutting down has been set at April 1, 1912.

Blast-furnace Types

Of the variety of blast furnaces I saw in 1889, there are only three left. The largest one, a circular furnace with seven tuyeres rated at 60 tons of charge, which was then ready for fixing up for the first time, was not running. It appears to be the prototype of all the round furnaces now in vogue in the Upper Harz. It is 16 ft. 8 in. high, which is also the hight of the big furnace at Friedrichshütte[2], and is provided with open breast and forehearth. The strong odor of arsenic pervading the atmosphere reminded me of the palmy days of Eureka, Nev., and gave evidence that ores different from those at other Upper Harz works were treated here.

In the blast-furnace building there was also housed a small H.-H. plant, consisting of one square roasting furnace in operation and two diminutive converters, which were not running. The ores are mixed in such a proportion that a bullion of 2 per cent. in silver; i.e., 583 oz., will result. The rich ores are smelted raw, those under 1 per cent. silver are roasted in admixture with lead concentrates in the H.-H. roasting furnace and agglomerated in the converter. The rich ores, like the Cobalt ores, containing 3000 or 4000 oz. of silver, are treated by direct absorption in a German cupeling furnace holding from 10 to 12½ tons of lead bullion.

Treatment of Products

The lead matte is roasted in kilns and smelted over with lead products repeatedly until it is sufficiently impoverished in silver and rich enough in copper for shipment to Altenau. The speiss is roasted mixed with pyritic ores in a long-hearth furnace and smelted over with lead products repeatedly until its nickel and cobalt content is sufficiently high to command a market. There is also a desilverizing plant of three pots which was not in operation. In it the clean lead from the reduction of litharge is treated by the Cordurié process. The impure lead bullion is exclusively cupeled and the cupel silver shipped to Lautenthal.

UPPER HARZ PRODUCTION IN 1909.

	Metric tons.	Value in marks.
Dressed zinc ore.....	19,046.76	2,768,380
Dressed lead ore.....	14,394.129	2,716,163
Dressed copper ore....	305.65	28,833
Silver and gold ore...	1.539	4,456
Arsenical ore.....	1.462	1,003
Total	33,749.54	5,518,835

The second dross (*abstrich*) from the cupeling operation is liquated in a German cupeling furnace on a bottom made of brasque. The argentiferous lead sweated out is cupeled while the liquated dross is reduced in a blast furnace to antimonial or hard lead. This is remelted in a pot, poled with steam, skimmed and brought up to a standard of 18 to 20 per cent. antimony by adding some soft lead, after which it is sold as refined hard lead.

The machinery required about the works does not differ much from that used at other Harz works. Blast is produced by Enke blowers which are moved by a turbine wheel, a stationary steam engine being kept in reserve in case of water failure. Two water wheels drive several small stamp batteries, a rock breaker and a bucket elevator; an elevator with water counterpoise is used for raising material to the charge floor.

The mines and dressing works, now idle, and the smeltery receive their power water through long ditches from Oder Lake at the foot of Mt. Brocken. The arrangements for sanitation, social entertainments and the spiritual welfare of the workmen are all that could be wished for. The accompanying tables gives the output of the Upper Harz mines for 1909 as published by the Mining Department at Berlin.

[1]Werner, "Die Silbererzgänge von St. Andreasberg," *Glückauf*, July 16 and 23, 1910.

[2]Eng. and Min. Journ., Vol. 89, No. 22, p. 1112, May 28, 1910.

Norwegian Water Power Development

The hydroelectric development of Norway, and its effect on chemical and metallurgical industries was the subject of a paper by A. Scott-Hansen, of Christiania, given before the Faraday Society on May 2, 1911.

The configuration of Norway is favorable for the utilization of the waterfalls to be found on the seaboard of the mountain chains which almost cover the country, and through whose valleys the enormous quantity of water precipitated from the western and southeastern sea breezes finds its way as rivers flowing to the sea. The volume of water is at its greatest from May to July, when the snows melt on the mountains. To make use of the water-power, storage is, therefore, necessary, and for this the nature of the country is peculiarly adapted, being covered with lakes that have contracted outlets and which can be converted by damming into storage reservoirs.

The total water power in Norway has been estimated at from five to seven million horsepower, but as much of the country has not been hydrographically surveyed, this is probably too low an estimate. The power stations can supply power at from $5.20 to $10.40 per horsepower-year, including capital charges, and in some cases even for less; and as the quantities available are as high as from 50,000 to 100,000 h.p. for a single fall, the conditions are ideal for the development of electrochemical and electrometallurgical industries. Many such industries have already reached an advanced stage of development. Thus nearly 180,000 h.p. will be utilized this year in the manufacture of nitrates of lime, soda and ammonia from the air by the Birkeland-Eyde process and the Badische Analin und Sodafabrik Company's process; about 60,000 h.p. are employed in the manufacture of calcium carbide, and other electrochemical and electrometallurgical industries absorb at present some 20,000 h.p. Now that a suitable electric furnace—the Grönwall—has been designed for the smelting of iron ore, a furnace that has yielded excellent results on a practical scale, electric iron and steel smelting is likely to develop largely in the near future, for Norway possesses extensive deposits of iron ore. Three plants, aggregating 16,000 h.p., with provision for increasing to nearly 60,000, are now being erected at Hardanger, Arendal and Tinfoss.

Coal Mining Department

The Important News Of Coal Mining. New Appliances, New Methods. New Fields, Colliery Engineering

The Explosion at Hulton Colliery

SPECIAL CORRESPONDENCE

The inquest on the 344 men who were killed in the explosion at the Hulton colliery near Bolton, Lancashire, England, on Dec. 21, 1910, came to an end on Monday, Feb. 13, 1911. The inquiry lasted 27 days, and in all over 400 witnesses were heard. The verdict of the jury was as follows:

On Dec. 21, 1910, at the No. 3 Bank pit, commonly known as the No. 3 Pretoria pit, Westhoughton, in the county of Lancaster, an accidental ignition of gas and coal dust occurred on the conveyer face in the North Plodder mine, in some manner to the jury unknown, but probably from a defective or overheated lamp, and produced an explosion.

That upon such ignition and explosion followed a large ignition and explosion of coal dust, affecting the whole of the coal mines working to the said pit.

That the victims were at the time of the explosions employed in the mines of the said pit, and in consequence of such explosions died there on the same day, so that they came to their deaths by accident and not otherwise.

To this formal verdict the jury added:

There is no evidence to prove that the explosion was in any wise due to the nonobservance of any statutory obligation.

That the evidence and the experience of the jury satisfy them that such headings as Bradley's in the South Plodder, and Brown's and Eccleston's in the North Plodder, are undesirable, unless provided with adequate ventilation, by means of bratticing, pipes or otherwise; in that they are calculated to be injurious to the health of the men working in them and likely to collect gas. They are also of opinion that the carrying forward of the heading at the top of the North Plodder entry, to the extent to which it was carried up, was unnecessary and calculated to produce danger from gas.

FURTHER OPINIONS OF JURY

That there seems to be some doubt, upon the evidence, as to the fitness of the men who have from time to time removed the switch box, and as to the sufficiency of the instructions given to them, and the jury are of the opinion that everybody dealing with an electrical plant should be under the direct supervision of a skilled electrician.

The jury also are of the opinion that the apparent failure of the night fireman in the North Plodder mine, to make his statutory report on the morning of Dec. 21, is evidence of laxity of supervision.

The verdict and criticisms are supplemented by the following recommendations:

(*a*) That it is a matter of immediate importance that the fullest investigation should be made into the dangers incident to coal dust in mines, and the best methods of removing or minimizing them; and also as to the character of the safety lamps, the use of which is to be permitted, and desire respectfully to represent to His Majesty's Government that these matters merit their attention and call for their financial assistance.

(*b*) That Electricity Rule 33 should be amended so as to provide that the switches, etc., referred to in the latter part of that rule shall be inclosed in a gas-tight box, and shall break under oil.

(*c*) That the firemen's report of gas should specify the exact places where found, and the quantity found, together with similar particulars regarding the adjacent places likely to be affected by it; and that all firemen's reports should be duplicated, and one copy preserved above ground.

(*d*) That full ventilation reports should be made at least monthly upon each and every airway in the mine.

(*e*) That the attention of the Royal Commission be called to the desirability of a definition of the term "return airway."

PROPOSED LAMP TESTING STATION

It is now reported, following upon the revelations made in the course of the inquiry into the Hulton Colliery disaster, that the Home Secretary has decided to establish a Government testing station for lamps, a small departmental committee having apparently been appointed to consider the details of establishment and equipment.

In their second report issued a few months ago, the Royal Commission on Mines made a recommendation on these lines. Referring to the experiments made by a previous commission, they reported:

"The proposal which we were asked by the Home office to consider went beyond the suggestion of that commission, namely, that the Government should set up a station for the testing of types of safety lamps, and that no safety lamp should be permitted to be used except of a type which had passed the Government test.

"We are strongly of opinion that such a test would not only tend to improve the type of safety lamps by stimulating invention but also prevent the use of imperfect lamps, such as have led to accidents in the past, and we therefore recommend that steps should be taken to establish a Government testing station.

"We also recommend that a list of permitted safety lamps should be drawn up by the Secretary of State, similar to the list of permitted explosives, and that the law should be so amended that where safety lamps are required to be used, one or more of the types of lamps specified in the permitted list should be used and no other."

Colliery Gas Power Station

SPECIAL CORRESPONDENCE

In the course of a paper on "Large Gas Engines of the Two-cycle Type" read before the Manchester Association of Engineers. A. E. L. Charlton says that in an electric station driven by gas engines arranged to run in parallel, and supplied with gas by two pressure producers, the producers are specially interesting in that they successfully burn "bastard" coal, which is fuel of very low grade, and for the ordinary sale purposes useless. The engines have twin cylinders arranged with cranks at 90 deg. to each other.

The alternators are direct coupled to the engines, and the excitation for them and the power for all the auxiliaries on the gas plant, as well as the lighting of the power station and mine, are supplied by a synchronous motor-generator set when the engines are running, and by a small steam-driven set when starting up. The alternators supply current for a large motor-driven ventilating fan, and a powerful haulage gear also electrically driven by motors connected through flexible couplings.

The haulage it is pointed out is of the endless-rope type, and is one of the largest driven in Great Britain. High-tension three-phased current at 2300 volts and 25 cycles is used, and the power is conveyed by overhead aluminum conductors, not only to the mine which the power house principally supplies, but also to two other coal mines at a distance from the power house.

Electricity at Alabama Coal Mines—II

By A. F. Elliott *

The second and concluding article dealing with electric equipment at mines of the Tennessee Coal, Iron and Railroad Company. At each of the new mines ventilating fans will have both electric and steam drive.

*Chief electrician, Tennessee Coal, Iron and Railroad Company, Ensley, Ala.

The most satisfactory electric mining installation from an operating point of view that I have had to deal with in electric mining work, is at the Whitwell mines of the Tennessee Coal, Iron and Railroad Company. The generating station, shown in one of the photographs, contains two 200-k.v.a., 2300-volt, three-phase Allis-Chalmers alternators with exciters, direct connected to Buckeye engines, shown during erection in illustration. A six-panel switchboard, with the usual instruments and switches arranged for parallel operation, controls the plant. These mines are in a seam of coal outcropping one mile from the railroad siding and are at 1000 ft. elevation above the power station, as shown in accompanying figure.

The coal is lowered to the tipple at the railroad side track in 10-ton capacity cars running on a self-acting plane; two cars holding 20 tons of coal being attached to each end of a 1⅜-in. steel cable running on double drums; the descending loaded cars pulling the empty cars to the top. The brakes on the drums are controlled by compressed air, furnished by compressors driven by these drums. It was not practicable to have the power station at the mines, for the following reasons: (1) Water was not available for steam purposes; (2) on account of the precipitous nature of the ground, a power-house site could have been obtained only at great expense; (3) it would have been necessary to run a power line down to the valley for pumping and the cost of this with the pump and discharge line to pump against 1000 ft. vertical head would more than offset any possible advantage of placing the power station at the mines. The 2300-volt, three-phase current is transmitted to the two substations located at the mine openings, 1¼ miles apart. Each substation consists of a 2080 volt, 225-h.p. induction motor, direct connected to a 150-kw., 250-volt, 514-r.p.m., direct-current, compound-wound generator, also a two-panel switchboard, consisting of one high-tension induction-motor panel and the 250-volt direct-current panel. The two substations are run in parallel, feeding into the trolley system without an equalizer connection of any kind.

Underground Equipment

The mines are equipped with one 10-ton, four 8-ton and one 4-ton Jeffrey locomotives. Two 60,000-ft. Capell fans, driven by 60-h.p. Westinghouse motors, take care of the ventilation for all of the five mines. Other small motors are used for various purposes. One 30-h.p. motor is used to drive a sawmill near the opening on the opposite side of the mountain from the substation, a distance of 2½ miles, where timber for the mines is delivered directly into the mine cars. One of the substations and a locomotive hauling a trip out of the mine opening is shown in accompanying photograph.

Another view shows a locomotive on the tram road between the mines with its trip of 40 cars. The trolley wire outside of the mine is supported on pipe brackets attached to the 30-ft. poles, carrying the high-tension line, and 15-ft. poles set 30 ft. apart. A portion of the line is shown in the illustration. The 10-ton locomotive running on the 1¼-mile tramroad can easily haul 800 tons per day in the 2000-lb. cars, hauling trips of 30 cars each. The eight-ton locomotive has gathered and delivered on the sidetrack more than 500 tons per day.

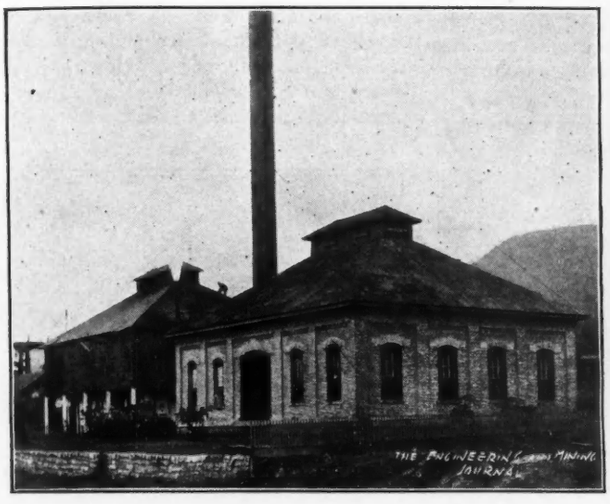
On account of the isolated situation of the mines, simplicity was given first consideration in the design of the plant and experience has shown that this was amply justified. The line from the power station to the upper tipple is made up of two independent circuits so that it is possible to run each substation on a separate generator in the event here should be any trouble about running the engines in parallel. Also the switches on the switchboard are so arranged that either one or both substations may be supplied from either generator. An automatic oil switch is connected between the two generators, making it impossible to throw the machines together when they are not in synchronism. Nonautomatic switches are used on each machine, and should they be thrown together out of phase, it does not cut the power off of the line, but simply puts each substation on its own independent line. Block signals are used between the sidetracks and where two or more locomotives deliver coal from different headings onto one sidetrack.

During the first year's operation, there were less than 10 hours' total delay on the entire equipment. One hour's delay was due to a hot bearing on the engine, and another hour was due to a short circuit on the high-tension line. Two hours' delay was caused by low-steam pressure and about five hours came from locomotives leaving the track. The total maintenance cost of the entire plant for the first year amounted to $200, being made up in two new sets of wheels for the locomotives, and a few journal-bearing linings, trolley wheels, etc. Our records for three years show less than 24 hours' delay on all of the equipment.

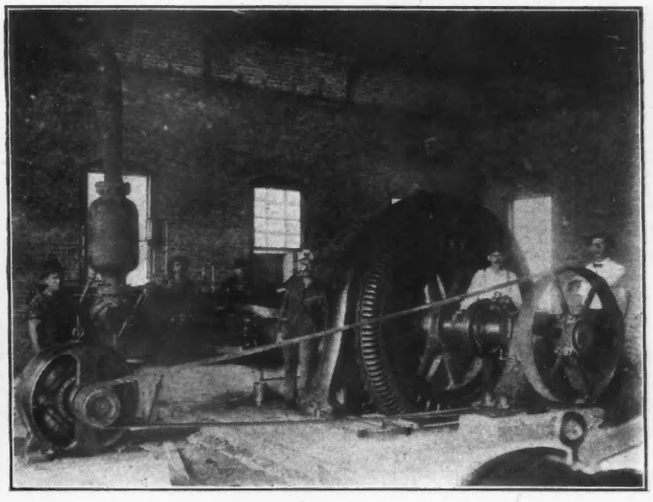
The Whitwell Mines are Situated at an Elevation of 1000 Ft. above the Power Station

One of the later equipments is at the No. 12 Shaft mine, which is in the Pratt seam, about four miles west of Ensley, Ala. A view of the headframe and tipple, with the power station, is shown in accompanying figure. The power station consists of two 250-kw., 250-volt, 140-r.p.m., compound-wound Northern generators, direct connected to a 20x33-in. Buckeye engine rated at 365 h.p. each. Another view shows the conical-drum Vulcan hoisting engine. Steam is furnished by a battery of four 72-in. by 18-ft. return-tubular boilers. The shaft is

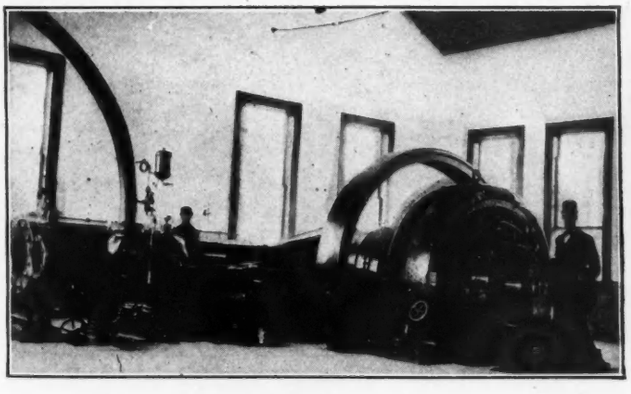
300 ft. deep, and is equipped with double 6-ton capacity skips running in balance. The mine is ventilated by a Lepley fan, built by the Connellsville Manufacturing Company, Connellsville, Penn., and is shown in accompanying figure. The fan is driven by a steam engine and like the fans at the other mines, is set at a safe distance from the air shaft, which is provided with self-closing explosion doors. The governor on the engine is provided with an electric signal, which sounds an alarm at the power station should the speed vary more than a predetermined amount from any cause. The main underground pumping station has two 6x18-in. 400-gal. triplex Connellsville pumps, driven by 60-h.p. Northern interpole variable-speed motors. The coal is gathered and hauled by six 6-ton and one 8-ton locomotive, after being undercut by 10 Sullivan continuous-cutting machines. Ingersoll-Rand electric air drills are used for brushing the rock in the headings. The mine is planned for an output of 2000 tons per day and is at present producing about 1250 tons. This is a modern mine in every respect.



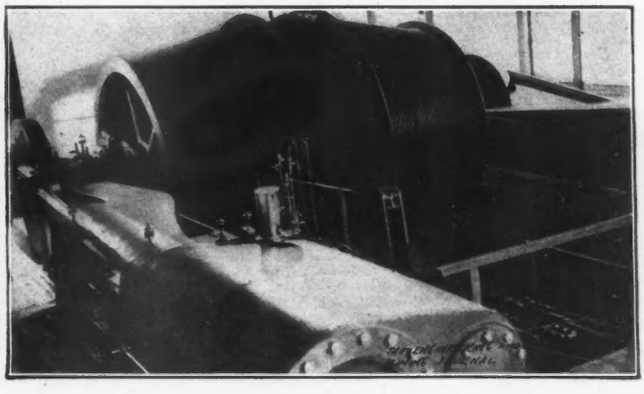
GENERATING STATION AT THE WHITWELL MINES OF THE TENNESSEE COMPANY



INTERIOR OF WHITWELL STATION DURING ERECTION OF MACHINERY



NORTHERN GENERATOR DIRECT CONNECTED TO BUCKEYE ENGINE



VULCAN HOISTING ENGINE AND LATEST TYPE OF CONICAL DRUM

BLOCTON DIVISION

The latest installation consists of a 400-kw. plant, erected in the Blocton division, for pumping purposes. The generating station consists of two 200-k.v.a., 2300-volt, 25-cycle, three-phase, Western Electric alternators, direct connected to 350-h.p. 150-r.p.m. cross-compound Harie-Tyne engines. The switchboard consists of seven panels of marine-finished slate, equipped with the usual switches and instruments for parallel operation. The plant supplies power for pumping at No. 2 and No. 3 mines and at No. 5 pumping station, which furnishes water for the town and for the boiler plants at three different mines. One 10x12-in. triplex pump is located in the No. 2 mine, and is driven by a 300-h.p., 2080-volt Western Electric induction motor. It discharges 1000 gal. per min. against a vertical head of 760 ft. A similar 12x18-in. triplex pump, with a capacity of 1500 gal. per min., and driven by a 200-h.p., 2080-volt Western Electric induction motor is used in No. 3 mine. The latter pump discharges to the surface through a borehole against a head of 400 ft. Triplex pumps of 200 gal. capacity, and driven by 30-h.p., 440-volt induction motors are used in the main slopes for sinking purposes. The 300-h.p. motor is located in the main pumping station one mile underground.

Power is transmitted at 2300 volts through a No. 4, three-core, rubber-insulated, lead-incased, wire-armored cable. Power is transmitted to the No. 3 mine, 8000 ft. distant, from the power station by a circuit of No. 2 bare-copper wire, carried on an overhead pole line and down the bore hole through a paper-insulated, lead-incased, wire-armored cable.

CABLE SUSPENDED IN EXHAUST PIPE

This cable was suspended in the exhaust pipe from the steam pumping station, thereby saving the cost of another bore hole. It was necessary to install the pump and cable complete, ready to operate before the steam plant could be closed down. The paper insulation was therefore used to better withstand the heat of the steam. The steam pump was left standing as a reserve in case of accident or an unusually heavy inflow

of water, but it has never been necessary to fire up the steam plant since the electric pump was put into service. The electric installation as a whole has been in continuous operation, both day and night shifts, for the past eight months. The power factor of the system is about 85 per cent. and it is proposed to drive the main ventilating fan at No. 2 mine with a 125-k.v.a., 2000-volt synchronous motor, by which it is expected to bring the power factor up toward unity.

Opening New Mines

The Tennessee company is now opening up two new shafts designed for a daily capacity of 2000 tons each, which will be modern in every respect. The shafts are concrete lined throughout and will be equipped with 6-ton capacity skip hoists. Everything about the mines will represent the last word in the science of producing coal safely and cheaply. Each mine will have two 250-kw., 250-volt Westinghouse generators direct connected to Buckeye engines. The ventilating fans will have both electric and steam drive. The coal will be all machine mined and hauled in steel cars by steel-frame electric locomotives, running on 40-lb. steel rails.

Coal Mining Fatalities in Tennessee

The following extracts concerning coal-mining fatalities in Tennessee, during 1910, from the report of the mining department are of interest. The total number of deaths occurring in the coal mines of Tennessee during 1910 were 38. The death rate per thousand employed was 3.40. As compared with 1909 this is an increase of 0.57. Of this increase 43 per cent. occurred at the State mines at Petros and was due to the employment of inexperienced convicts in the mines. The remaining portion of the increase was caused from three deaths occurring at one time from shooting from the solid in direct violation of the rules of the mining department.

The causes of fatal accidents are as follows: Dynamite explosion, 4; electric current, 2; fall of roof or coal, 22; mine cars or motors, 4; powder explosion, including premature and delayed blasts, 6; total, 38.

The fatal accident death rate in the coal mines of North America per 1000 employed, in 1909 was 3.39. In 1908 it was 3.84, and in 1907 it was 4.15; for the 10-year period 1900-1909 it was 3.46. While the death rate in Tennessee increased during 1910, it is 0.06 lower than the average death rate per thousand employed in North America for the 10-year period 1900-1909.

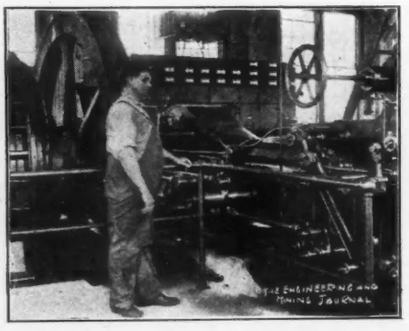
Owing to the appalling loss of life incident to the many recent mine explosions throughout the country and an enlightened public opinion demanding it, the question of accidents to mining employees in Tennessee is receiving more serious consideration than ever before.

Accident Reports

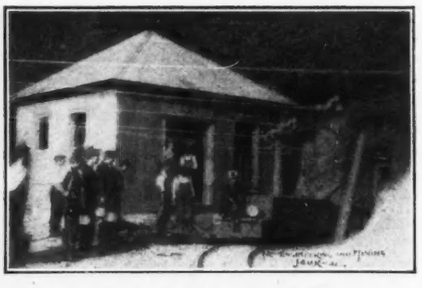
The forms of the department for the accident reports are progressive in their character, and call for age, race, conjugal conditions, occupation, date of accident, date and hour of death, exact place where accident occurred, cause of accident, including all surrounding and contributory circumstances and elementary facts in connection therewith.

The death rate in the coal mines of foreign countries is only about one-half the death rate of North America. The death rate in this country is too large and should be reduced. It has assumed normal proportions in Tennessee since the passage of the present mining laws in 1903 enabling the department to formulate and enforce mining rules and discipline, but it can be further reduced by the employment of intelligent and scientific effort in the regulation of the

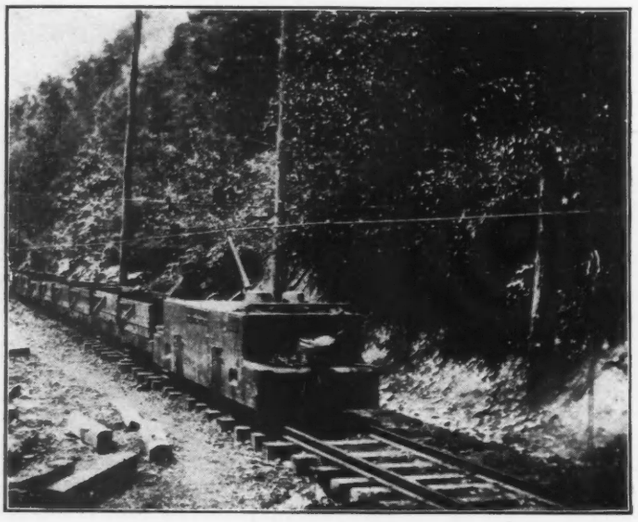
Lepley Fan at No. 12 Mine



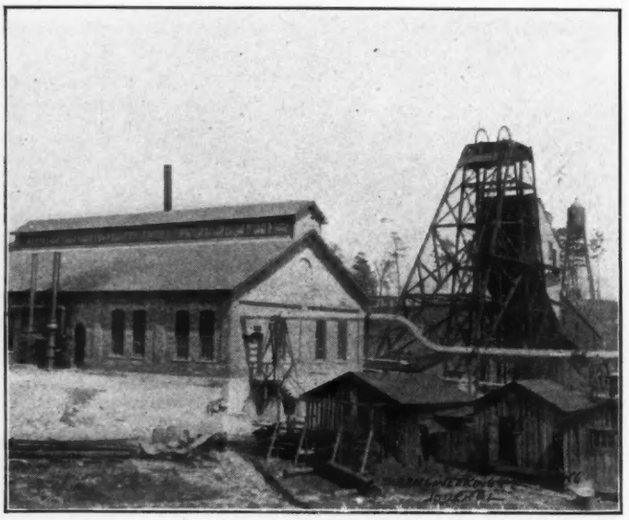
Generators in No. 12 Station



Substation Situated at Mine Entrance



Locomotive on Tramroad Hauling Trip of 40 Cars



One of the Later Equipments Showing Steel Headframe

moisture in the air in the mines as a precaution against gas and dust explosions, and by requiring when it is absolutely necessary to shoot from the solid, that the shooting shall be done by experienced shotfirers, and then only after all miners have been registered on the outside; also, by constant and diligent attention to the condition of the roof by mine officials, and by a full appreciation on the part of the miner of the dangers surrounding him when the roof is not properly supported.

In addition to the fatal accidents reported there were 210 accidents in the coal mines of Tennessee that were not fatal. It will be observed that of the total accidents occurring, 15.32 per cent. were fatal, which is practically 2 for every 13 accidents. The figures for the United States as a whole show one death to every 4.3 accidents occurring. Of the total accidents, 51 per cent. were due to falling roof and other substances, 27.01 per cent. were due to mine cars and motors, 5.65 per cent. were due to powder explosions and windy shots from premature or delayed blasts, 1.61 per cent. were due to gas explosions and 14.73 per cent. due to other causes.

The Barometer and Firedamp

The idea that there is a connection between atmospheric pressure as indicated by the barometer and outflows of firedamp into mine workings was discussed by mining men as far back as 1844. An English publication, known as the *Mining Almanac,* printed in the year 1844, contained a long table by Prof. T. D. Ansted, calling attention to the relation between explosions of firedamp and falls in the barometer. The table shows a record back as far as the year 1803, and because of its historical, as well as its scientific value, is here reproduced.

An examination of the table shows that out of 62 explosions, 34 occurred after a fall in the barometer. In eight cases, there was no change in atmospheric pressure just preceding the accident, while in 20 cases the explosion followed a rise in the barometer.

An investigation of this same subject over recent years, shows a similar tendency to favor the theory that a falling barometer causes an increased danger from firedamp; however, as in the earlier examination above cited, the proofs are not conclusive.

EXPLOSIONS OF FIREDAMP AND BAROMETRIC READINGS

Date	Collieries	Killed	Day before Explosion	Day of Explosion	Day after Explosion	Wind	Weather
Sept. 25, 1803	Wall's End	13	30.30	30.20	30.30	—	Fair
Oct. 21, 1805	Hebburn	35	30.25	30.20	30.15	N.	Fair
Nov. 29, 1805	Oxclose	38	29.90	29.40	29.03	E.	Fair
Nov. 28, 1806	Killingworth	10	29.90	29.93	30.03	S.	Fair
Nov. 29, 1808	Harraton	4	29.65	29.45	28.90	N.	Fair
Sept. 14, 1809	Killingworth	12	29.50	29.50	29.80	E.	Fair
May 25, 1812	Felling	92	29.90	29.85	29.80	W.	Fair
Oct. 10, 1812	Barrington Mill Pit	24	29.35	29.35	29.30	S.E.	Fair
July 17, 1813	Collingwood Main	8	29.50	29.70	29.85	W.	Fair
Sept. 28, 1813	Hall Pit, Fatfield	32	29.95	30.05	30.20	E.	Fair
Dec. 24, 1813	Felling	22	29.70	29.85	29.90	S.E.	Fair
April 5, 1814	Hawden Pit, Percy, Main	4	29.60	29.60	29.80	W.	Fair
Aug. 12, 1814	Hebburn	11	29.80	29.60	29.40	S.W.	Fair
Sept. 9, 1814	Leefield	4	30.00	30.00	30.00	E	Fair
June 2, 1815	Sheriff Hill	11	30.20	30.10	30.10	S.W.	Fair
Dec. 18, 1815	Townley	1	28.90	29.15	29.20	S.W.	Fair
June 30, 1817	Row Pit, Harraton	38	29.65	29.50	29.35	S.W.	Fair
Sept. 25, 1817	Jarrow	6	29.80	29.30	28.70	S.W.	Fair
Aug. 5, 1817	Wall's End	4	29.50	29.80	29.80	S.E.	Fair
Nov. 3, 1817	Ouston	1	29.70	29.90	29.80	S.E.	Fair
Dec. 18, 1817	Plain Pit, Rainton	27	29.20	28.40	28.70	S.E.	Fair
July 19, 1819	Sheriff Hill	35	29.40	29.50	29.10	S.	Fair
Oct. 9, 1819	George Pit, Lumley	13	29.70	29.60	29.40	S.	Fair
Oct. 19, 1821	Nesham's, Newbottle	6	29.55	29.45	28.60	S.W.	Fair
Oct. 23, 1821	Wall's End	52	28.90	29.00	29.25	S.	Fair
Oct. 23, 1821	Felling	6	28.90	29.00	29.25	S.	Fair
Feb. 21, 1823	Ouston	4	29.60	29.00	29.15	S.E.	Rain
Nov. 3, 1823	Plain Pit, Rainton	59	29.90	29.60	29.40	S.E.	Fair
Oct. 5, 1824	George Pit, Lumley	14	29.50	29.10	28.70	S.	Fair
Nov. 19, 1824	Dolly Pitt, Newbottle	11	29.15	29.50	29.40	S.W.	Fair
July 3, 1825	Julit Pit, Fatfield	11	29.80	29.65	29.80	W.	Fair
Oct. 5, 1825	Hebburn	4	29.45	29.55	29.55	W.	Fair
Jan. 17, 1826	Jarrow	34	30.35	30.25	29.95	S.W.	Fair
May 30, 1826	Townley	33	29.75	29.75	29.65	N.E.	Fair
Sept. 5, 1826	Heworth	5	29.50	29.55	29.20	N.E.	Fair
Oct. 27, 1826	Benwell	2	29.20	29.25	29.60	N.W.	Fair
Mar. 15, 1828	Jarrow	8	29.95	30.00	29.80	S.E.	Fair
Sept. 1, 1828	New Pit, Houghton	7	29.80	29.70	29.70	S.E.	Fair
Nov. 20, 1828	J. Pit, Washington	14	29.60	29.50	29.30	N.W.	Fair
Dec. 3, 1829	Willington	4	29.60	29.40	29.60	S.E.	Fair
Aug. 3, 1830	Jarrow	42	29.10	29.40	29.00	N.W.	Fair
July 9, 1831	King Pit, Wreckington	3	30.00	29.90	29.90	W.	Fair
Sept. 20, 1831	Willington	7	29.53	29.50	29.50	S.E.	Rain
May 9, 1833	Springwell	47	29.85	29.60	29.75	W.	Fair
May 24, 1833	Great Lumley	2	30.10	30.05	29.80	S.E.	Fair
Nov. 1, 1833	Black Fell	3	30.06	30.07	30.04	—	—
June 18, 1835	Wall's End	102	30.09	30.11	30.10	—	—
Nov. 19, 1835	Burdon Main	11	29.66	29.84	29.85	—	—
Jan. 28, 1836	Down's Pit, Hetton	22	29.91	29.62	29.34	—	—
Dec. 6, 1837	Springwell	30	30.37	30.12	29.80	—	—
Dec. 19, 1838	Wall's End	11	30.31	30.22	30.20	—	—
June 28, 1839	St. Hilda	51	29.89	29.68	29.95	—	—
June 6, 1840	Haswell	1	30.05	29.87	29.83	—	—
April 19, 1841	Bigge Pit, Willington	32	29.65	29.65	29.62	W.	Fair
Aug. 5, 1841	Thornley	9	29.60	29.32	29.48	S.S.E.	Fair
Aug. 17, 1841	Haswell	1	29.78	29.78	29.73	—	—
Mar. 2, 1842	West Cramlington	1	29.21	29.48	29.63	N.W.	Rain
April 5, 1843	King Pit, Wreckington	28	29.29	29.44	29.58	W.N.W.	Fair
Jan. 18, 1844	West Moor	5	30.13	30.05	29.93	W.N.W.	Fair
Sept. 28, 1844	Haswell	95	30.012	29.852	30.12	W.N.W.	Chan.
Oct. 15, 1844	Coxlodge	1	29.92	28.83	28.82	W. by N.	Fair
Dec. 1, 1844	Seghill	2	30.18	30.15	30.07	S.	Dull

The Production of Peat Fuel

The yearly production of peat fuel in the United States, as reported by the U. S. Geological Survey, is approximately 1200 short tons, having an average value of about $3.60 per ton. The highest price reported was $5 per ton.

More than a dozen companies produce peat for fertilizer uses. Also, a single firm in Indiana in one year made 1254 short tons of peat-moss stable litter. Peat is used to a small extent in the manufacture of refrigerating plants as an absorbent in small admixture with mineral wool, and also as an ingredient of certain kinds of stock foods, especially those containing beet-sugar molasses and other sugary wastes.

In Europe its use in stock foods has become extensive, and has been approved, after careful tests, by the veterinarians of agricultural experiment stations and of some of the armies. Peat of the right sort makes an excellent absorbent for the molasses, rendering it easy to feed and also preventing fermentation.

For many years there has been an annual importation (about 10,000 short tons) of peat litter into the United States for use in the large coastal cities, the largest importations being at New York, Philadelphia taking the second place. This material comes chiefly from Holland, and is brought into the country in burlap-covered bales. The peat from which it is made is evidently dug from the upper, poorly decomposed layers of beds of sphagnum and sedge peat, such as are of frequent occurrence in the northern part of the United States, especially in the New England States, but also in New York, Michigan, Indiana, Wisconsin and Minnesota. As bedding for horses and stock this peat litter is serviceable and desirable, and it should be more widely produced and used than it is in this country.

To Open Utah Coal Property

A survey is being made to determine the best line for a railroad into the Castle Gate coal properties owned by the Union Coal Company, in Carbon county, Utah. When this is determined, it is proposed to build a road and equip and develop about a square mile of coal-bearing territory. W. J. House is president of the Union company, and the main office is in Salt Lake City.

Michigan College of Mines Celebration

By P. B. McDonald *

Twenty-fifth anniversary of this school to take place in August, 1911, when a widely scattered body of alumni will reassemble. Short synopsis of the work and aim of the college.

*Iron River, Mich.

The Michigan College of Mines, at Houghton, Mich., will observe its 25th anniversary in a four-day reunion celebration planned for the week of August 6. Those who will participate are experienced, technically trained men, representing the important mining districts of the world. F. W. McNair, president of the institution, has spoken with President Taft, and with George W. Perkins, of New York, in regard to their visiting the college at that time, and both will endeavor to be present. Special M. C. M. cars will be run from convenient centers throughout the West and the Lake Superior country. The celebration will not be confined to the graduates of the college, but the invitation has also been extended to the nongraduate M. C. M. men.

The Alumni

Five hundred and seventy-one men are graduates of the college. It is remarkable that but 12 have left engineering pursuits. A large number have developed from strictly technical positions into the operating and commercial side of mining. Nearly 200 of the alumni are in the iron ranges of Michigan, Wisconsin and Minnesota, and the Lake copper country, in the heart of which the college is situated. Moreover, this great field, the name of which symbolizes standard mining, serves as a recruiting station for other districts, and many graduates prominent in the industry over the world received their initial experience from several years spent in the iron and copper mines. Next to the Lake Superior country comes the Southwest where, in Arizona and Mexico, over 100 Houghton alumni hold positions. The remainder are scattered in this country, Canada, South America, the Philippines, Australia, New Zealand, South Africa and Europe.

In addition to the business interest felt in the Michigan country, the reunion will for some partake of the nature of a homecoming. Many of the men, born and raised in the district, left for out-of-the-way corners of the earth soon after graduating; not a few married copper-country girls, and it is expected that these will return (not unaccompanied), prepared to spend some time in the vicinity.

The Celebration

There will be four days of formal celebration. Time will be reserved for class and group reunions, and there will occur carefully planned excursions about the copper country, which has changed considerably since last seen by some of the graduates. It is predicted that an era of closer intercourse will be initiated by this reunion of old friends and classmates, all engaged in the same business, for the mining industry is one in which there is a large opportunity for coöperation, and the alumni could materially increase their helpfulness to each other by systematic attention to the matters of mutual interest. To this end the college purposes issuing a small booklet, giving the present and permanent address and occupation of each graduate.

The College

The Michigan College of mines was established by act of the State legislature, and is maintained as a State institution. The sole purpose of the college is to train men for mining. This concentration on a particular line of training does away with many perplexing problems which arise when numerous lines of effort are proceeding simultaneously. The tendency for concentration is furthered by the dominating mining environment. Within a radius of 11 miles from the college are 15 active copper mines, where in constant operation are the deepest shafts and the most powerful mining machinery in the world. Due to a change of about 30 deg. in the dip of the ore-bearing Keweenaw series, the shafts and methods of mining are varied considerably, so that different types can be observed. Stamp mills, reverberatories, and blast furnaces are also accessible to the student classes through numerous, carefully conducted trips.

A few hours railroad journey to the southwest are the half dozen ranges comprising the greatest iron-producing district in the world. Here are large, irregular, oxidized orebodies of widely varying hardness, the mining of which is often complicated by shifting-quicksand overburdens and serious water problems. Five weeks of the regular college schedule are devoted to visiting the iron mines where the mining and timbering methods, and mechanical details and construction work are carefully sketched and reported upon. Exceptional opportunities for geological field work are offered by the multi-bedded, intricately folded and metamorphosed Pre-cambrian formations of the Lake Superior region, and the summer course in this subject under Professor Seaman is the most elaborate field-geology course in the country. The regular schedule is a three-years course. The college year is from Oct. 1 to Sept. 1, and the daily hours are longer than at other colleges.

Faculty

F. W. McNair has been president of the college for the last 13 years. In that period most of the present buildings were erected, and the courses considerably enlarged and expanded. The president has given much time to keeping up correspondence with mining companies, a phase of the chief executive's duty that at some schools is neglected or left to associates. The members of the faculty are frequently consulted upon technical questions by mine operators throughout the country. Perhaps the most widely known are: A. E. Seaman, professor of geology and mineralogy; Prof. O. P. Hood, who is a consulting engineer on the subject of mining machinery; Prof. F. W. Sperr, an authority on mine ventilation and mining methods; and Dr. George Augustus Koenig, head of the department of chemistry.

A board of control, appointed by the governor of the State, has general supervision over the affairs of the college. William Kelly, general manager of the Penn Iron Mining Company, which is the mining department of the Cambria Steel Company, is chairman. The other members are: James McNaughton, general manager of Calumet & Hecla; Murray M. Duncan, agent (or general manager) for the Cleveland-Cliffs Iron Mining Company; Hon. J. M. Longyear, mine owner and operator; Dr. L. L. Hubbard, general manager of the Ojibway Mining Company, and of the St. Mary's Canal Company's mines; Hon. W. D. Calverly, manager of the Sheldon-Calverly mining interests, director of the Copper Range railroad and various other mining organizations.

The Student Body

The student body numbers about 250. Many of these are men who have had experience along practical mining lines, and it is possible for persons of sufficient maturity who have not had the requisite high-school training, to take up special work, but not to be candidates for a degree. The busy curriculm does not allow so much time for class or social events as at most other colleges, although the fine club house and gymnasium, which was built from subscriptions among friends and graduates of the college, is the center of activities outside of classroom and laboratory, and contributes materially to the social life of the students.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

There will shortly be a vacancy in a junior position on the editorial staff of the JOURNAL. Applicants must have had some mining experience.

S. F. Shaw is at Elkton, Virginia.

W. Laing Malcolmson, of London, England, is at Porcupine, Ont.

W. B. Thompson, of New York, has sailed for Europe. He will return in July.

James G. Ross, of Montreal, has joined the Milton Hersey Company, Ltd., of that city.

M. W. Summerhayes has been appointed manager of the Swastika gold mine, Porcupine, Ontario.

George A. Shroter, consulting engineer of the Mines Company of America, has returned to New York from Mexico.

H. P. Henderson, of the Mines Management Company, New York, is examining claims in the Porcupine district, Ontario.

Frederick F. Sharpless was in British Columbia last month, examining gold properties at Sheep creek, Nelson mining division.

Cooper Shapley has been appointed superintendent of the Oro Grande mines at La Luz, Guanajuato, Mexico, in place of Mr. Richards, resigned.

John J. Marony, of Butte, Mont., has been elected a director of the Amalgamated Copper Company in place of James Jourdan, deceased.

M. L. O'Neale has been appointed superintendent of the mines of the Seaboard Coal and Coke Company at Coal City, St. Clair county, Alabama.

Walter S. Bickley has been chosen president of the Penn Steel Castings and Machine Company at Chester, Penn., in place of Mortimer H. Bickley, deceased.

J. Cuthbert Welch has resigned as smelter manager for the East Butte Copper Mining Company at Butte, Mont., and has gone to Spokane, Wash., for the present.

Frederick E. Browne has closed his office at Goldfield, Nev., and will hereafter make his headquarters at Salt Lake City, Utah, with office in the Newhouse building.

Dr. James Douglas, of New York, who is a graduate of Queen's University, Kingston, Ont., has made a donation of $10,000 to the School of Mining, affiliated with the University.

Walpole Roland, of Port Arthur, Ont., is making an examination of iron ore properties in the Atikokan district, near Fort William, on behalf of a number of American capitalists.

W. D. B. Motter, Jr., has been transferred by M. A. Hanna & Co., from Crystal Falls, Mich., to a position as manager of the Canada Iron Mines, Ltd., with headquarters at Trenton, Ontario.

M. H. Kuryla has resigned his position as metallurgical engineer with the Esperanza Mining Company and is now associated with the Merrill Metallurgical Company at the new Santa Gertrudis cyanide plant at Pachuca, Mexico.

J. J. Shannon, furnace manager for the Sloss-Sheffield Steel and Iron Company, has returned to Birmingham, Ala., from a trip to New York and points in Pennsylvania. Mr. Shannon has been employed about Alabama furnaces for more than 20 years.

Charles W. Drysdale, of the Geological Survey, of Canada, is working out the areal geology and structure of Franklin camp, Boundary district of British Columbia. O. E. LeRoy will examine the mining properties and prepare the economic geology of the camp.

Norman Fraser has resigned as superintendent of the Crow's Nest Pass Coal Company's colliery at Michel, B. C., to become manager for the German Development Company, which has large deposits of coal on the eastern slope of the Rocky mountains, Kananaskis, Big Horn, and the Brazeau fields, Alberta.

George F. Kay, who has been for four years professor of petrology and economic geology in the University of Iowa, has been elected head of the Department of Geology to succeed Professor Samuel Calvin, who died recently. Professor Kay has also been chosen by the Geological Board to succeed Professor Calvin as director of the State Geological Survey.

OBITUARY

Clyde Smith, who had been mining engineer at several mines in Mexico, killed himself at Guanajuato, May 28. He was about to take charge as manager of the Ojuelos mines at Ojuelos, Jalisco.

Victor A. Judson, mining engineer and graduate of the University of California, was killed by a cave at the Alaska mine, Pike City, Sierra county, Cal., May 24. He had gone ahead of the shift into an incline to direct the work of opening a drift. Mr. Judson had been employed in the mines of Sierra county for the past six years. His remains were sent to San Diego, his former home.

Harold J. Incledon Reed died in the mountains some distance from Huaraz, Peru, on March 22, aged 27 years. He hailed from Camborne, Cornwall, England, and received his education in mining engineering at the Camborne School of Mines. His first position was as mine surveyor at a colliery at Llanelly, South Wales, whence he removed to Bromwich, near Birmingham, to occupy a similar position. Later on he went to work for the Huinac Copper Mines, Ltd., at Huaraz, Ancacho, Peru, where he occupied various positions until the company suspended operations. He then went down nearer the coast and took charge of the survey of a railroad for the Peruvian government. While carrying out this work he contracted pneumonia, from which he died. He was interred at Huaraz. He was a thorough and successful student and of a remarkably companionable disposition and has fallen in the first stages of what promised to be a most brilliant career—to the great regret of many friends.

Charles D. Lane died at Palo Alto, Cal., May 26, aged 72 years. Mr. Lane had been a resident of California for 60 years, going there from his birthplace, Palmyra, Mo., with his father, who settled at Stockton. He was the pioneer prospector of some of the biggest mining operations in the West, not confining his activity to California. His first fortunate venture was on Snake river, Idaho, and his later successes were in Alaska, where he made a big strike on the Seward peninsula in 1898, and was instrumental in the construction of the railroad between Nome and Anvil creek. Mr. Lane led the fight against the Government regarding the rights of prospectors, and was an influence in the jailing of Judge Noyes. He was owner of the Wild Goose mine, at Nome, the Fortuna, in Arizona, and the Utica mine, at Angels, in Calaveras county, Cal., in which he was associated with Alvinza Hayward and W. S. Hobart. Within the present year he visited the Angels, and predicted continued success for the mines in that district. Mr. Lane was prominent as a free-silver advocate, and nominated W. J. Bryan for the presidency in 1896. His health had been failing for the last year.

SOCIETIES and TECHNICAL SCHOOLS

Lehigh University—The exercises of university week will begin at Bethlehem, Penn., June 9, and will end with the commencement on June 13. The graduating class includes 10 candidates for the degree of engineer of mines; four for metallurgical engineer; six for electrometallurgist, and four for chemical engineer.

American Iron and Steel Institute—At a meeting of the directors in New York recently, the old officers were reëlected, as follows: President, E. H. Gary; first vice-president, Powell Stackhouse; second vice-president, Willis L. King; third vice-president, Charles M. Schwab; treasurer, Edward Bailey; secretary, James T. McCleary. The committee on welfare work reported that it had engaged Dr. Thomas Darlington, for six years health commissioner of New York City, to have immediate charge of this work.

Editorial Correspondence

Reports from our own Representatives on Important Events from Many Important Mining Centers of the World

San Francisco

June 1—The Anti-Dèbris Association, accepting the report of its engineer. J. C. Boyd at its recent meeting, found that the dredges operating in the Oroville district are causing no pollution of the waters of Feather river except in an inconsiderate technical sense. The determination of the engineer was based on an investigation begun in February when the section visited had been saturated from heavy rains. In only one place in the entire district was there found contamination of the waters from the outflow of the flotation ponds; and this may and will be cured. One of the dredge companies recently restrained from operating, by judicial proceeding, was found to have conformed to the order of court and is now causing no contamination. In his report Mr. Boyd makes recommendations for the complete suspension of the contaminating outflow, or at least to prevent any increase in the per cent. of impurity. In the effort of the association it has been largely assisted by practical labors of the Oroville Dredge Miners Association. My own observation in the field confirms the general expression that the dredge miners in this and other districts are consistent in their individual and combined labors to prevent any pollution of the waters of the rivers; and only one instance is reported or observed of resting on purely legal rights. Where there have been actual causes for complaint the reports of damage have been usually exaggerated.

A writ of citation for contempt of the injunction of the United States Circuit Court has been served on the Balaklala Copper Mining Company, returnable June 19. After investigation by the chemist reporting to the farmers whose lands are in the vicinity of the smeltery at Coram, Attorney Shanahan filed with the court 56 affidavits of members of the association, a consensus of which declares; that the sulphuric acid is not eliminated before the smoke of the furnaces is taken into the Cottrell device; that the process is not eliminating all the solid particles in the smoke; that more than 0.75 per cent. sulphur dioxide is allowed to pass into the atmosphere; that the sulphur dioxide is injuring the crops and the property of the farmers. The Balaklala company will answer that it has installed an effective smoke-cleaning process. It may also be shown that the smeltery and mine, even in the limited operation necessitated by the installation and testing of the Cottrell process, are employing 500 men and extracting and treating 800 tons of copper ores. During the investigation which resulted in the citation for contempt there has been but little complaint by the farmers.

Denver

June 1—"The Grub Stake" or prospectors' fund, started by the *Denver Republican,* and turned over to the Denver Chamber of Commerce, is now being boosted by that body. Several thousand dollars have already been subscribed and business men as well as mining men all over the State are sending in their subscriptions. The Chamber of Commerce has appointed the following well known mining men to take charge of this work: James Doyle, Max Boehmer and Ernest L. Foster.

It is just 20 years since Colorado was stirred by the simultaneous discovery of Creede and Cripple Creek, and today, even lacking such a stimulus as the discovery of a new camp, the State is tingling with expectancy, beginning to think mines, want mines and talk of mining revivals. Concerted action to meet and encourage it, would be a blessing that could only be paralleled by a return of the old mining spirit to the people growing out of the resolution on the part of every individual to put forth his best licks on his own account and make a fresh try at the game.

The Roosevelt deep drainage tunnel will be continued another 1000 ft. east into Beacon hill, in order to tap the Gold Dollar water courses. Work of driving the main headings will commence within a week. The money necessary is being raised and will be forthcoming immediately. The leading contributors are the Elkton, El Paso, Cresson, Portland, Granite, Strong, Gold Cycle and Vindicator companies.

Butte

June 1—That the Anaconda Copper Mining Company is making real headway in its campaign of lowering the cost of copper production is evidenced by the fact that in 1910 a production of 223,808,546 lb. of copper was made at a cost of 9.89c. per lb., as compared with a production of 75,860,194 lb. in 1909 at a cost of 11.1c. per lb., and this, notwithstanding the fact that development to the extent of 33.1 miles was done which was charged to copper costs. For the last three years the company has shown a deficit after the payment of dividends, but encouraging results of the present policy of retrenchment were obtained in 1910, and especially in the last half of the year when, in spite of the fact that that market price of copper was lower than in either of the two previous years, a deficit of only $5987 was shown in the earnings after the regular dividend payments were made. As the above production of 223,808,546 lb. of copper was made during the period of curtailment, the normal output should average about 290,000,000 lb. yearly, and on this basis, with the cost of production reduced to 9c. per pound, as predicted for it by the company in the near future, the regular dividends of $2 per share on the 4,332,500 shares outstanding, could just be earned, with copper at the present low price, and on each one-half cent advance in the metal, profits would be increased by 34c. per share.

Duluth

June 2—The shipments for May over the line of the Duluth, Missabe & Northern show a large decrease over the corresponding month of 1910, being less than half. The total shipments for May, 1911, were approximately 920,000 tons, as against 2,220,758 tons for May, 1910. The number of trains in use on this road daily between the Mesabi range and the docks at Duluth averages about 20, whereas 35 to 40 were employed last year. While this same condition is probably true in the case of the Duluth & Iron Range, an entirely different state of affairs exists on the Great Northern line, and the present conditions seem to bear out the predictions made earlier in the season as regards the properties served by this road. The Great Northern has a contract with the Steel Corporation whereby it receives certain tonnages. Under the terms of the lease by which the Steel Corporation is operating certain of the Hill properties, the tonnages and royalties increase from year to year, with a corresponding increase in the tonnage to be hauled by the Great Northern. The road is hauling from 1200 to 1500 cars of ore daily to the Allouez docks, and the additional capacity provided by the new dock is proving none too much. It is expected that this road will haul about 10,000,000 tons of ore from the Mesabi this season.

The district of which Chisholm is the center, on the Mesabi range, seems to be one of the busy spots on that range this season. At the Leonard, Meyer, Clark and Chisholm mines, seven steam shov-

els are employed in all in stripping and loading ore from the stock piles. At the three last and at the Glen, Euclid and Elizabeth ore is also being mined from underground. In the Hibbing district, the record day for this year was May 22, when 1600 cars of ore, totaling 65,000 tons, left the Kelly lake yards of the Great Northern railroad for the docks at Allouez. The largest shippers that contributed to this total were: The Cole, 335 cars; Mahoning, 150 cars; Leonard, 200; Hill, 185; Stephenson, 150; Grant, 100, and 90 from the Latonia.

Marquette, Mich.

June 1—The surplus stocks of iron and the general slowness in the iron industry have resulted in curtailment orders being issued by the Oliver Iron Mining Company, the mining department of the United States Steel Corporation. This order does not extend to all of the company's mines but includes some mines in the Ishpeming district of the Marquette range and in the Ironwood district of the Gogebic range. In the vicinity of Ishpeming, the Section 16 and the Hematite mines will be worked only four days per week, and the night shift will be dispensed with at all the properties. On the Gogebic range the same order will apply to the Puritan, Pabst, Aurora, East Norrie and Norrie mines. The reduction in forces will total about 450 men on each of the two ranges, in addition to a large number of surface men that have been laid off. The remaining surface men will work the same hours as the miners. On the Menominee range, as far as is known, six shifts per week will be worked, but no night shift will be employed. The Penn Iron Mining Company at Norway, Vulcan and Republic will also lay off a number of men and curtail generally. The Cleveland-Cliffs company has not yet ordered any curtailment, and it is hardly probable that it will in view of the fact that some properties which have been closed have only recently been reopened. It is hoped retrenchment in connection with the continued shipping will so reduce stocks and restore a normal condition.

Indianapolis

June 5—There was a slight improvement in mining conditions during the past week—just enough, operators say, to start hope in a revival soon. There was a perceptible improvement in the booking of orders for fall delivery and the demand for steam coal is rather more active. The mines are working on an average of three days a week and the railroads are moving the product promptly. Trade and crop prospects display irregular results, but an improved tone is in evidence. The operators in many instances are making extensive improvements to their mines, especially in the facilities for loading coal on the cars.

Toronto

June 2—The Porcupine branch of the Temiskaming & Northern Ontario railway will be extended into the Pearl Lake district west of the Hollinger mine. The Timmins-McMartin syndicate has agreed to finance the extension by giving the Railway Commission a loan of between $100,000 and $150,000, upon which 5 per cent. interest will be paid. It is expected that this extension will be finished by August.

The new provincial tax on stock transactions of 2c. per $100 of par value of shares came into operation in Ontario, June 1. Transactions will be registered by the secretaries of the exchanges, who will make weekly returns to the Government.

Victoria, B. C.

May 31—The party of Granby officials and expert advisers including Benjamin B. Lawrence, of New York having returned from a visit of examination to the Hidden Creek copper mine, on Observatory inlet, British Columbia, it is understood that the several reports on the property, and on transportation and smelting conditions on the coast, are to be considered by the directors of the company shortly, with a view to deciding whether or not to proceed with the purchase of the Hidden Creek mine and accompanying property. It is asserted by one of the company's consulting engineers that exploratory work in driving and with the diamond drill appears to warrant an estimate of at least six million tons of ore available in the mine under option.

Chihuahua

June 1—Throughout Chihuahua, Durango, Sinaloa and Coahuila the mining industry suffered severely during May, due first to the interruption of railroad traffic and secondly to the interference of operations incidental to actual or threatened capture of nearly all the large cities and important mining camps by the revolutionists. It should be stated, however, to the credit of the revolutionists no serious damage to either the person or property of foreigners, except that incidental to the forced suspension of operations, resulted.

For the entire month Chihuahua city was isolated, having neither mail nor telegraphic communication. Owing to lack of coke the Chihuahua smeltery of the American Smelting and Refining Company closed its five furnaces on May 20 and will not be able to blow in again before June 15. Owing to the condition of the railroad south it will be impossible to bring in coke or coal from the Coahuila fields for several weeks, and shipments from El Paso will be greatly retarded on account of congested freight at the border and the permanent repairs under way for the entire 200 miles of trackage. In other words smelting operations will not be resumed until a permanent fuel supply is assured. The blowing out of the furnaces not only occasioned the laying off of workmen at that plant but also a considerable number in the camp of Santa Eulalia where ore shipments were of necessity discontinued. The larger companies in that camp are, however, continuing development. The May production of the camp was under half the normal tonnage.

The mining camps tributary to Chihuahua also suffered on account of the Federal embargo placed on the sending of foodstuffs out of the city, this embargo being necessary, however, owing to food shortage arising from the suspension of railroad traffic from supply points in United States and Mexico and to the fear of a state of siege had not peace terms been arrived at. The majority of the camps in the Sierras fortunately had sufficient provisions to enable the continuance of operations on somewhat reduced scale.

Since May 15 operations in the Parral district and in the camps accessible therefrom have been almost at a standstill on account of the tieup of railroad traffic and the infesting of the region by hundreds of revolutionists. Several companies, including the Veta Colorado, San Francisco del Oro and Arizona-Parral suspended work, while all curtailed operations. The same condition prevailed in the tributary northern Durango camps of Guanacevi, Indé and Magistral, and it will be several weeks before work can be resumed on any considerable scale on account of shortage of foodstuffs and mining supplies.

During the entire month practically no coal or coke production was recorded from the Sabinas, Esperanza or other coalfields of northern Coahuila, and such important camps as Sierra Mojada and Mapimi in the same state were almost deserted except for a few watchmen. The smeltery at Torreon was also closed.

With the certainty of peace, however, repairs to the damaged lines of the National Railways have been pushed and the first train to run over the line from El Paso to Chihuahua in about four months has arrived. The work of repairing the line south will be rushed, but it will be several weeks before regular service can be inaugurated inasmuch as railroad officials state their knowledge of about 100 bridges destroyed between Chihuahua and Torreon, and about as many on the Torreon-Eagle Pass route. Coincident with railroad repairs preparations are under way on the part of mining companies for the early resumption, and with normal conditions continuing the industry throughout the northern states of the Republic will soon be on a substantial basis again.

The Mining News

Reports of New Enterprises. New Machinery. Installations. Development Work and Property Transfers. The Current History of Mining

Arizona

Gila County

Ray Central—Three churn drills are being used on the Globe-Isabella claims, prospecting holes varying from 400 to 1200 ft. The proposed consolidation with the Arizona-Hercules is meeting with favor locally. The formal proposition has been made by the respective officials and is now being considered. The consolidation will be effected on a basis of mine valuation. Under the figures recently submitted as the result of development it is estimated that Ray Central has 12,000,000 tons of positive ore, while Arizona-Hercules is credited with 7,000,000 tons blocked. The Ray Central company has authorized $2,000,000 in bonds, of which only $200,000 are outstanding. The proceeds of this bond issue will be used in the construction of a mill. The consolidation plans are being handled by J. B. Cummins, who represents the new controlling interests in Ray Central, and by W. P. Dunham, who is the controlling owner in Arizona-Hercules.

Ray Consolidated—The two unloading tipples are satisfactorily placed in No. 1 mine and 1400 tons of ore is shipped to the concentrator at Hayden daily, and is being treated by the unit constructed to mill 1000 tons per day.

National Mining Exploration Company—Formal protest against the sale of the property to the Iron Cap Copper Company has been filed in the Boston court by Charles M. Bruce, former president of the National Company.

Keystone—The compressor and boiler formerly used by the Miami have been purchased, and will be installed for use. Mining will be suspended until this is completed, when work will be resumed with air drills. A tramway will be built from the property to the Miami concentrator, where Keystone ore will be treated. There are now about 75 Mexicans working on the tramway road, grading it. With the added improvements the company will have five churn drills working on the claims.

Santa Cruz County

Float Gold—This company has installed a Nissen stamp mill near Nogales on a gold-quartz vein. L. A. Hartman is superintendent.

Yavapai County

Bagdad Copper Company—This company owns 165 claims, 26 miles from Hillside on the Santa Fe railroad. The property has been under development for four years; over 8000 ft. of tunnels, crosscuts, etc., have been run, and about 100 holes have been put down by drills. It is estimated that between five and six million tons of copper ore (chalcocite in porphyry) have been developed in one block, averaging 2 per cent. copper with some gold and silver. The company is capitalized for 1,300,000 shares, par of $5.

California

The option held by the Byllesby syndicate, of Chicago, of purchase for $8,000,000, or $80 per share of the stock of the Northern California Power Company, was not exercised. There were various reports of a consummation of the sale, but the holders of the option surrendered the forfeit money and failed to make the first payment of $100,000 on the purchase price. The terms of purchase were to have been 75 per cent. in cash, payable in two years, the balance, 25,000 shares, payable in securities.

Amador County

There are four dividend-paying mines in Amador county: The Kennedy, South Eureka, Bunker Hill, Fremont. Those yielding a margin over expenses are: Argonaut, Central Eureka, Zelia and Original Amador, though with no regular payments to the stockholders. The prospects are good for all of these to soon be in the regular dividend class.

Calaveras County

Lightner—Twenty stamps are now dropping on good ore, and the full 60-stamp mill will be going soon. The present owners, the Lightner Mining Company, have nothing to do with the Coleman-Lightner litigation, it is said, so that the stockholders are not affected by the outcome of the suits.

Eldorado County

Georgia Slide—Major B. A. Cardwell has sold his interest in this mine, and Herman Barklage has succeeded him as manager. Thirty men are employed, and additional Beers mills are being installed.

Imperial County

Quartz claims located 40 miles west of Brawley near Carisso creek are reported to have produced several hyacinths. Some of the stones were sent by H. C. Barfell and L. H. Boyle, of Brawley, to be cut and proved to be of good value; the color varies from orange to deep red.

Inyo County

Good reports come from the old Chrysopolis district. Old properties are continuing development and new claims are being located. C. C. Beauregard of Laws is working a lease on the Black & Lochrie mine. S. P. Shriver, of Pittsburg has a bond on the Everett and McClemmens group. D. C. Adamson has opened new ground that prospects above the average. Horn silver and lead have been uncovered in the John Beauregard claim.

Several mines are shipping ore via Keeler to the Salt Lake smeltery. Elder brothers shipped 65 tons of zinc ore said to run 40 per cent. Campbell & McDougal are shipping 40 tons of high-grade gold ore. The Santa Rosa has a large shipment ready. The Jack Wardel mine delivers one wagon load per day for shipment. These shippers are situated at Insurrecto camp about four miles from Keeler.

Troeger—R. C. Troeger, manager, plans to haul the ore from this mine to Keeler, four miles, with a heavy traction engine. The mine is owned by the Estella Mining Company.

Kern County

Caliente Consolidated—This mine is working two shifts and opening new oreshoots. The mill is being overhauled.

Barbarosa—A strike of pay ore is reported in this mine in Caliente district.

Eureka—This group near the Caliente Consolidated has been sold to Duluth men.

Glenn-Olive—The shaft on this mine in the Pioneer-Keysville district is down 460 ft. The 15-stamp mill is operating and it is expected that the number of stamps will be increased.

Nevada County

Independence—A strong, vein was disclosed by a find of rich free-gold quartz at the bottom of the 240-ft. shaft. The ore is characteristic of the Alleghany district. Fred A. Pearson, manager.

Coan—In addition to sinking a new shaft this mine has been explored for 500 ft. in drifts and raises. The 20-stamp mill and hoist are under one roof. The 100-ton orebin is connected with the 45-ft. gallows frame. Four concentrators will be installed.

Arctic—Contracts for machinery and preliminary arrangements are said to have been made for the erection of reduc-

tion works at this mine on Cañon creek near Washington. The wagon road to Emigrant Gap is being repaired. J. P. Flint, manager.

Reber—A distillate engine will be installed. The 70-ft. shaft is being unwatered. The new shaft is down 400 feet.

Union Hill—The mine has been unwatered to the 350-ft. station, and a crosscut started to intersect the vein. It is estimated that sufficient ore will be uncovered to keep the 20-stamp mill going when it is in readiness.

Trinity County

San Francisco capital which acquired the Payne ranch near Trinity Center is negotiating for the adjoining lands, with a view of installing 7-ft. bucket dredge which was operated in the Callahans district.

J. P. Harrison, of the U. S. Geological Survey, who has spent thre years in Trinity county, returned from Washington heading a party of engineers to initiate the survey of the Big Bar quadrangle, which includes most of the mines in the New River district. Later in the season the work on the Weaverville quadrangle will be completed.

Tulare County

Tulare Mining Company—The 1400-ft. tunnel on this magnesite property at South Tules is completed. The tunnel is a double-header, planned by Bartlett Stevens. The heads of the two drives of 1000 ft. and 400 ft. met within 10 in. Magnesite in commercial quantity is reported.

Colorado

Boulder County

A reduction of $1 per ton on the treatment of Boulder county ores has stimulated the mines in the telluride belt.

Wolf Tongue—This company will continue to buy tungsten ore, having set aside $100,000 for this purpose.

Clear Creek County

Work was started this week on the excavations and foundation for the new mill of the Idaho Springs Milling Company to be erected at Idaho Springs. The new mill will have an initial capacity of 25 tons of ore daily.

Amie—A body of high-grade smelting ore has just been uncovered on the Silver Plume side of Leavenworth mountain. It is 14 in. wide and a mill run has returned $105 per ton in gold, silver and lead. Work has been in progress for three months and shipments of $45 ore have been going out.

Capital—The output of these mines now averages nearly 200 tons a day, with prospect that this amount will be doubled within a month. At the top of the 300-ft. raise carried on the Aetna vein a body of smelting ore has been exposed that is 18 in. to 2 ft. wide and mills $125 per ton in gold, silver and lead, with gold predominating. McKirlhan & Co., leasing in the east drift, are making regular shipments of smelting and concentrating ore. Thirty tons of first-class shipped recently returned $78 per ton in gold and silver.

Gilpin County

Phoenix-Burroughs—The sale is announced of the Phœnix-Burroughs group of claims, the Monroe, Conlee Burroughs, and all that portion of the Kansas vein lying west of the Alger-Kansas to the east end line of the First National-Kansas vein, on Quartz hill, to an English syndicate for half a million dollars.

Gunnison County

Pandora—The Pandora, at Pitkin, will start with a full force in a short time. One machine will be run for a couple of weeks on the main heading and then the second machine will be started in the west drift. The company recently received a new Leyner stoper. The Pandora is said to be looking good, and with a little more development on it one or two of the main veins will be cut.

Lake County—Leadville

Highland Mary—Ore is being shipped from the second level, and as soon as the surface water abates the shaft will be sunk 100 feet.

Little Ella—The work of cleaning out the old drifts in the Little Ella, Little Ellen hill, has been completed, and several small streaks of ore are now being followed, which may lead to an oreshoot.

San Juan Region

Ledge—Orebodies have been developed that guarantee sufficient ore to keep the mill running. Formerly the mill has been operated at 100 tons per day capacity, but five cars of machinery have reached Silverton and the mill will be improved and its capacity doubled.

Sunnyside—During the last winter the mill at Eureka has been thoroughly overhauled and is now doing better work.

Silver Ledge—W. Z. Kinney, formerly manager of the Gold King, at Gladstone, has been appointed manager.

Gold King—Louis Beker has resigned the management of the Gold King, and J. O. Campbell, formerly with the Gold Prince, is in charge.

Bagley Tunnel—For the last year work has been going on continuously at the Bagley tunnel, above Animas Forks, and the development done has exposed orebodies of good grade. The work done under Manager Charles Gagner has placed the property in such condition that the owners decided to proceed with the erection of a mill, the work of constructing the same to begin during the present season.

Summit County

The mining outlook is the brightest in several years. The three gold-dredging companies are taking out placer gold at a rate of $60,000 to $80,000 per month. The new method of working high-bar placers with steam shovels, introduced by the Buffalo Gold Placer Mining Company, near Dillon, will be watched with great interest by owners of high-bar placers that have not enough water available for hydraulic mining.

Wellington Mines—Production is regular and systematic development is being done.

Dunkin—The 205-ft. raise is completed, making available a new lot of stoping ground in the big lead-gold-silver oreshoot.

Farncomb Hill—The recent discovery of wolframite in the free-gold veins of Farncomb hill caused considerable interest to be aroused in tungsten mining in this vicinity.

Teller County—Cripple Creek

The gold output for the Cripple Creek district for May was gratifying to that camp, being $1,450,000 and excess of $10,000 over the highest month in 1911. The tonnage was 78,485.

The Portland mill, at Colorado City, reports 10,000 tons treated in May, which is the full quota. The Stratton Independence plant handled over 10,000 tons, while the Golden Cycle mill, at Colorado City, treated more ore than during any month in the last two years. The U. S. plant worked every day to full capacity.

El Paso—The output for May will run considerably over 100 cars. Of this, the company will contribute about 40 cars and leasers the rest. The average yield will be about $25 a ton. The water in the El Paso's main shaft has receded about a foot.

Jerry Johnson—Fresh ore strikes are reported in the 550-ft. level, where the vein is 3 ft. in width and of excellent grade. St. Louis men have resumed work in the Midget, while the Flying Cloud, on Bull hill, has a strike that runs $90 per ton. David Mason, leasing on the Stratton estate, has a 10-ft. vein at 550 ft., which is classed as milling ore.

Isabella—The company is going ahead with development in the Lee shaft, running drifts and crosscuts on the 5th, 9th, 11th and 12th levels to the side lines, and all ore above the water level will be opened before stoping commences.

Doctor Jackpot—The quarterly report shows that 14 sets of lessees are at work and the royalties paid by them in the last quarter amounted $2561. The cash on hand is $12,789.

Gold Soverign—About 60 tons of ore from the Gold Sovereign dump has been

sent to the Anaconda mill to be tested by Pascal Craig. If the test proves successful sub-lease on the pump will be given. The grade of rock is said to be between $5 and $8 per ton.

Indiana

Greene County

One hundred and fifty miners in the Linton field returned to work May 31, when the Black Creek mine, burned five months ago, resumed. The capacity of the mine is 1100 tons daily. The shaft is 88 ft. deep.

Sullivan County

Trouble continues, and clashes between miners and operators regarding who should hold the qualification certificate occur daily. The miners contend that they should be the custodians of the certificates which they lawfully obtained and quote the following section of the new law: "No person shall hereafter be engaged as a miner in any coal mine in that State in which 10 or more miners are employed without first obtaining a permit or certificate as required by this act. No person, firm or corporation shall employ any person as a miner who does not hold a certificate or a permit, as aforesaid, and no mine foreman, or superintendent or other person shall permit or suffer any person under his charge or under his supervision, as a miner, who does not *hold* such certificates or permits." The miners content that the word "hold" should be interpreted to mean just what it says.

Vigo County

President John D. White, secretary Edwin Perry and Vice-President Frank J. Hayes, of the international United Mine Workers, held a conference with the operators' officials in Terre Haute, May 30, in an effort to bring to an end the strike at seven mines in this county. The effort was futile. Twelve hundred men are idle as a result of the strike, which was caused by the discharge of a miner for having assaulted the mine superintendent and because two working rooms are not provided for each miner.

Michigan

Copper

It is understood that enough shares of the Atlantic have been deposited in favor of the merger with the Copper Range Consolidated to insure the success of the plan.

Indiana—The shaft has reached the lode at a depth of about 110 ft. Power drills have been installed and sinking started.

Wolverine—The crosscut from the 28th level eastward has been extended about 1000 ft. and within the next 400 ft. to the boundary line it is expected it will penetrate the lode exposed on the Old Colony.

St. Louis—The Calumet & Hecla has uncovered in the pit on the site of the proposed permanent shaft, a promising copper-bearing amygdaloid formation of promising appearance. The temporary surface equipment is being delivered to the shaft site and the formation will be opened up as rapidly as possible. A number of drill cores have been taken at various points, showing good results.

Menominee Range

Fogarty—This mine, in the Iron River district, has been idle for about a year, but will be put into commission by the Pickands-Mather Company. It is practically a new mine and will be thoroughly developed.

Jones & Laughlin—The company has commenced the development of a property on Sec. 14, north of Iron river. The ground has been explored by diamond drilling and a deposit outlined at a depth of 135 ft. A drop shaft will be sunk.

Jackpot—This Jones & Laughlin property, in the Bessemer district, has been closed for a number of years. It adjoins the Yale mine, where a large deposit is being developed by the Lake Superior Iron and Chemical Company, and it is hoped that the same deposit extends into the Jackpot. It is supposed that previous exploration of the latter tract was not carried deep enough. New machinery will be installed and the old workings will be unwatered.

Minnesota

Mesabi Range

Holman—This mine, at Taconite, owned by the Steel Corporation, has resumed operations after a shut down since early last fall.

Schley—This mine has recovered the pumps which were recently drowned out, and work has started again. An air-line has been laid to the Petit mine to assist in sinking the shaft of the latter mine a distance of 150 feet.

Hobart—The Hobart mine, closed for several months on account of litigation over the title, has resumed.

Leonidas—Pumps have been installed at the 350-ft. level and shaft-sinking operations have been resumed. On surface, a machine shop has been erected and a dry house and office are under construction. Plans have been drawn for 19 more houses for employees.

Montana

Butte District

Applications have been made to list $2,812,500 additional capital stock of Anaconda Copper Mining Company. The application is in connection with issuance of Anaconda stock to Amalgamated Copper Company for purchase of the Clark properties.

Butte & Superior—The annual statement of the Butte & Superior company has just been filed; it shows capital stock of $2,500,000. The liabilities amount to $851,202, of which $799,342 is in bonds, $41,860 in secured accounts, and $10,000 due on a one-half interest in the Enterprise lode claim.

Butte Central—William H. North, president, has been making a personal inspection of the company's Ophir mine. He left Butte May 25 for Montreal, where a meeting of the directors will be held.

Berlin—On May 24, John D. Pope and Harry A. Holp, as directors for the Berlin Mining Company, filed a petition in the district court of Butte for a decree of dissolution of that company. The corporation was organized for the purpose of working the Berlin claim, which has since been sold to the North Butte company.

Pittsburg & Montana—The company, which formerly owned the Pittsmont mine and smeltery has filed an annual statement showing a capital stock of $30,000,000. All the assets of the company have been sold under a bond mortgage foreclosure by the Union Trust Company. The Pittsmont Copper Company, former bondholder of the above company, shows a capital of $6,000,000, with liabilities of $5,088,681. The East Butte company, which now owns the Pittsmont interests, has a capital of $6,000,000, with $459,520 liabilities.

Tuolumne—On May 25, the south crosscut on the 1600-ft. level of the mine, encountered the south ledge, which is supposed to be an extension of the North Butte Edith May vein. The vein has been cut for a width of 5 ft., carrying from 5 per cent. to 12 per cent. copper with the crosscut still in ore. Drifting on the north ledge on the 1600-ft. level is being pushed and much high-grade ore is being mined. The company is shipping from 150 to 200 tons of ore daily to Anaconda, and producing about 1,000,000 lb. of copper per month.

Nevada

The Eureka & Palisade railroad purchased by the U. S. Smelting, Refining and Mining Company under foreclosure, has been redeemed by the Mills interest. Work of reconstruction awaits an agreement between these parties regarding tonnage and freight rates. The road is important as an outlet for the Richmond-Eureka ore.

Comstock Lode

Mexican—A north drift is being driven on the 2400-ft. level in the ore vein, and is within 30 ft. of the Union Consolidated south boundary line. The vein is filling with excellent-grade ore the further north the header is extended. Raises have been started the past week in the vein from the 2500 and 2300 levels, and are being carried up through high-grade ore. Stoping in first-grade ore is

underway above the 2500 level. Returns received on 162 tons of ore shipped to the Selby smeltery averaged $90 per ton, netting the company $11,100. During May, Mexican extracted $66,577 from the development work in the vein; total output since March 1, $142,408.

Ophir—During last week 262 tons of ore were stoped from the Hardy vein on the 2100 level, giving total of $11,774. A rich streak in this stope gives assays of about $300 per ton. East crosscut on the 2500 level, now out 160 ft. from the winze station, passed through bunches of low-grade quartz. Drifting southwest will soon be started.

Con. Virginia—Ore of increased value is being taken from the raise near old workings on the 1750-ft. level.

C. & C.—Auxiliary hoist has been installed on 2450 station, to be used in clearing sump below the 2650 station. Powerful new pumps will be installed on the latter station.

Esmeralda County

The plant of the Pacific Hydroelectric Power Company, at Mono, wrecked by snowslide in March, is again in operation and service to the Goldfield district is again supplied.

Begole Syndicate—The townsite controversy so far as it concerns the Goldfield White Rock and Goldfield Kebawgan Mining companies, has been settled in favor of the mining companies by decision handed down by the secretary of the interior, in which the title of the mining companies is established. The result will be that the White Rock company will probably resume work within the next 30 days and sink the shaft to 1200 or 1400 ft. A working capital of $50,000 has been provided. The shaft was sunk to about 750 ft. under former operations. The White Rock property includes four locations—the Alpha, Apazac, Yellow Jacket and White Rock. The Kebawgan company owns the Omega, the Fraction, White Horse and Blue Jay. The White Rock and Kebawgan companies are controlled by the Begole Mines Syndicate, of which F. W. Begole, of Marquette, Mich., is the head. Capt. Thomas Hooper is manager.

Goldfield Consolidated—The estimated gold production was 29,410 tons; gross value recovered, $882,000; operating cost $215,000; net profit, $667,000. The mines are looking well.

Nye County

Tonopah-Belmont—Estimates have been received for the new mill and cyanide plant.

New Mexico

Socorro County

Tri-Bullion—The company, after a test run on 2000 tons of lead-carbonate ore, has put its mill at work again on lead-sulphide ore. It is said that the test on the lead-carbonate ore was satisfactory.

Utah

Beaver County

During the first three months of 1911 the mines of Beaver county shipped a total of 8100 tons of ore and concentrates to the Valley smelteries. The properties that furnished the greater part of this tonnage were the Moscow, Horn Silver, South Utah, Cedar Talisman, Majestic, Red Warrior and Hub. Aside from the South Utah at Newhouse and the Horn Silver at Frisco, most of the properties are handicapped by a wagon haul to bring their ores to the railroad, and during the early part of the year the roads were in bad shape, making transportation doubly difficult. The tonnage shipped, however, was about one-third as large as that shipped from Park City during the same period, and between one-eleventh and one-twelfth that sent out of Tintic.

South Utah—During April an average of 720 tons daily was milled, or a total of 21,743 tons, which produced 1959 tons of concentrates. The concentrates contained 300,137 lb. copper, 145 oz. gold, and 2690 oz. silver. During the first half of May the capacity was increased to an average of 800 tons daily. On May 21 one section of the mill was shut down to install Janney classifiers. The mill is composed of two sections, and it is expected that the entire reconstruction and installation work will be completed early in June, when larger capacity and a better saving are looked for. From May 1 to 16, 13,303 tons of ore were milled. For the last five or six months, the ore has been of considerably lower grade than the average claimed for the mine, i.e., 1.1 per cent. as against 1.79 per cent. The extraction has been in the neighborhood of 65 per cent. The orebody which was cut on the 600 several months ago, and which was reported to show 4.75 per cent. copper for a distance of 95 ft. has been reached on the 700 level. It is of lower grade here, but is said to be commercial ore.

Majestic—This company's Harrington-Hickory property has been shut down for some weeks on account of an unusually heavy flow of surface water. The shaft is down 600 ft., and the pumps for some time were handling a heavy flow of water but were found to be inadequate. It is rumored that suit will be brought in Boston against buyers of the shares recently sold by auction for non-payment of assessment.

Utah Mining, Milling and Transportation—The shaft on the Lady Bryan property has been sunk to the 400-ft. level and crosscutting to the vein has been done. Shipments were suspended while this was in progress. Considerable shipping ore has been produced on the upper levels. On the 300 ore is being mined from a fissure, and on the beds. The bins are full, and a considerable tonnage is broken in the mine, awaiting arrangements for shipping to the railroad at Milford. There has been talk of installing a traction engine.

Blackbird—This property adjoining the South Utah has done considerable drilling during the last few months. A new combination gasolene hoist and compressor has been shipped from the east, and is expected shortly. Sinking will be started, as soon as the equipment is installed. The company is backed by Pennsylvania interests.

Sheep Rock—Two cars of ore shipped a short time ago from this property north of Beaver City are reported to have brought over $6000. The ore came largely from the 160-ft. level of the property. There is a wagon haul of 40 miles to Milford, which costs $5 per ton. A small experimental mill was recently installed, but was not entirely successful, and new machinery is being considered.

Juab County

Opohongo—A dividend of 1c. per share payable June 10 was declared May 23. This is the first dividend, and amounts to about $9000. Sinking is in progress below the 550 level on good ore. The showing is strong at the present depth of 25 ft. below this level.

Black Jack—Leasers are continuing shipments of first-class gold ore. The gold vein encountered was small, but is widening. Some work is being done on company account in a part of the old Star Consolidated territory. So far this has opened little ore. It has been proposed to make arrangements with the Lower Mammoth so that the Black Jack can use the latter company's shaft, which is 2000 ft. or over in depth, in opening up its territory. The Higginson lease on the south end of the property has a car of silver-lead ore ready for the market.

Dragon Iron—Recent development on the 800-ft. level has opened fissures carrying quartz with some lead. This point is between 4000 and 5000 ft. south of the Iron Blossom, and corresponds to the 1300 level of the latter.

Centennial-Eureka—A dividend of $3 per share was paid April 12. The United States Smelting, Refining and Mining Company owns 99,864 shares of the 100,000 shares issued. Since 1906, the Centennial-Eureka has paid $30 per share in dividends.

Sioux Consolidated—The shaft is down 560 ft., and will be driven to the 590 or 600 level, before a station is cut and prospecting begun for the orebody opened near the 450-ft. level.

South Swansea—It is reported that preparations are being made to resume at this property, which lies about 4000 ft. south of the Swansea Consolidated.

Swansea Consolidated—Sinking was commenced May 20, and is being carried on with three shifts.

Canada

British Columbia

Owing to the collieries in British Columbia and Alberta from which coke is usually obtained being closed, the respective smelteries of the Consolidated Mining and Smelting Company of Canada, Ltd., at Trail, the Granby Consolidated Mining, Smelting and Power Company, Ltd., at Grand Forks, and the British Columbia Copper Company, Ltd., at Greenwood, all in British Columbia, are procuring coke from Pennsylvania to keep their several works in operation. As there is no present prospect of work being soon resumed at the Canadian collieries affected by lack of agreement between the operators and the representatives of their employees, it is probable the smelteries will have to depend upon an outside coke supply for several months, or suspend smelting operations until such time as the existing dispute shall be settled and the men return to work at the collieries affected.

Ontario

Laurentian—The Golconda Mining Company is making active preparations to resume mining operations on this property in the Manitou Lake district. New concentrating machinery is being put in.

Moose Mountain—These mines at Sellwood, 25 miles north of Sudbury and employing 250 men, were closed down indefinitely May 28, the cause assigned being an overproduction of iron ore. Work will be commenced on the new concentrating plant to cost $300,000, giving employment to as many of the miners as possible.

Ontario—Cobalt

The shipments for the week ended May 26 were: La Rose, 275,680 lb.; McKinley-Darragh, 246,370; Nipissing, 205,640; Buffalo, 107,170; Townsite, 80,480; Right of Way, 73,320; City of Cobalt, 66,000; Hudson Bay, 64,370; Kerr Lake, 60,000; Beaver, 58,850; Crown Reserve, 50.080; total, 1,287,960 lb. Bullion shipments, Nipissing, 37,872 ounces.

Kerr Lake—The company has declared the regular quarterly dividend of 5 per cent., with a 5 per cent. bonus. A new high-grade vein has been found on the 140-ft. level, and in addition to this several important discoveries have recently been made.

Meteor—Work has been resumed on this property.

Nancy Helen—The power plant of this mine was destroyed by fire June 1, entailing a loss of $16,000. Operations had been suspended for some time.

Waldman—At this mine on the Gillies Limit, the shaft is being unwatered prior to the resumption of operations. A gang is at work trenching with the expectation of striking new veins.

Beaver Cobalt—Nine drills are at work and the shaft is now down to 420 ft. A station has been cut at the 400-ft. level, from which crosscutting will be at once commenced to prove up No. 3 vein at that level.

Wettlaufer—Shareholders in this South Lorrain company are becoming anxious regarding the declaration of the quarterly dividend. The company was put on a 2½ per cent. quarterly basis, the last dividend being paid March 11. The next should come on June 11, but during the interval, the control has changed hands, and no dividend announcement has been made.

Nipissing—It is the plan to immediately sink a shaft to a depth of 1000 ft. at vein No. 64, which has been very productive at a depth of 245 ft. In sinking to the 1000-ft. level crosscuts will be run every 100 feet. This deep shaft is for exploration. The deepest working in the camp now is about 500 feet.

Pearl Lake—The fire did not cause this company to lose any time in work but the store and supplies were burned.

Ontario—Porcupine

West Dome—A third shot drill was started last month. This drill is made for deep drilling and will cut the vein at approximately 1000 feet.

Imperial—The station on the 100-ft. level is being cut. Crosscutting has been started to cut the veins exposed on the surface. Spectacular gold showings are to be seen in these veins.

Booth-Armstrong—The extension of the Jupiter lead has been traced for 350 ft. on this property, being 4 ft. wide in some places. The vein has been cut at 83 ft. with a diamond drill, giving good results at that depth.

Swastika—A meeting of shareholders has been called for June 8 to sanction an increase in the capital from $1,000,000 to $2,000,000, to raise funds to pay for the new mill and to secure additional claims.

Hollinger—Already a new hoist is on the property to replace the one damaged by the fire, and by the time the shaft is retimbered the plant will be ready and development work carried forward as before. Supplies are being carried in on jumpers. The fire loss in buildings and supplies is estimated at $175,000 and a set back of four months. The foundation for the mill and much of the machinery were not damaged.

Rea—President C. Plummer Hill states in an official circular that a vein 23 in. wide, showing gold, has been struck on the 200-ft. level, 15 ft. from the shaft. Where the No. 1 or main lode was cut by shot drill at a depth of 240 ft., the sections of the drill core containing vein matter assayed $19.20 per ton, excluding the parts containing visible gold.

Mexico

Mines Company of America—The stock of this New York company, owning El Rayo and Dolores mines in Chihuahua and La Dura and Creston-Colorada in Sonora, has been listed on the London Stock exchange.

Sonora

The mine owners at San Javier are planning building an aërial tram from the mines at San Javier, to the Rio Yaqui railroad, a distance of 12 kilometers.

Greene-Cananea—The railroad service has been restored and shipments of bullion out and receipt of concentrates from Miami has been resumed. The company has reopened the Henrietta mine. The output in May was 4,098,000 lb. of copper compared with 3,664,000 lb. in April, 3,542,000 lb. in March, 3,986,000 lb. in February and 3,604,000 lb in Jan. The production of the mines in May was the largest monthly output reported this year.

Buena Vista—This mine, near San Javier in the district of Hermosillo, is being steadily worked, much ore being blocked and some of the high-grade being shipped to El Paso.

Las Animas—W. C. Laughlin has leased the mine near San Javier. The 50-ton concentrator is being overhauled and the mine put in shape to begin stoping. The vein averages 15 ft. wide and is opened to a depth of 600 ft. There is 50,000 tons of ore blocked.

Belen—B. H. Augdon is opening this mine at La Barranca. The mine has been a producer, but shut down in the '90's. The machinery for the hoisting and pumping plant will be installed soon.

Black Mountain—Foreclosure proceedings, instituted by the security holders' committee, representing $167,414 bonds, have been brought against the Black Mountain Mining Company in the Chicago courts. The company spent upward of a million dollars in equipping and developing the Cerro Prieta mine, near Magdalena.

Central America

Guatemala

Guatemala Mining and Development Company—This company, headed by A. E. Spriggs, formerly of Montana, has secured a concession of broad character, including the right to prospect and acquire any unlocated mineral lands in the public domain for a period of three years. The concession is a liberal one, permitting the operation of public utilities, etc. At present A. E. Spriggs and S. W. Gebo are in Guatemala with a corps of engineers to prospect the country. The New York office of the company is in charge of L. A. Sarecky, secretary-treasurer, at 115 Broadway. Bids are being received for mining machinery of various types, among which are two dredges.

The Markets

Coal Trade Review

New York, June 7—Some improvement is beginning to be manifest in the coal trade in the West. The demand for steam coal seems to be improving at several points, and larger shipments are being made. Most mines, however, are still running short time and the trade represents not over 60 per cent. of producing capacity. Lake trade is still rather slow.

The seaboard bituminous trade is quiet, not to say dull. Consumers are taking supplies only in moderate quantities, and prices are low.

The anthracite trade has quieted down after its spurt of activity in April and May. Deliveries are good, however, both in seaboard and all-rail territory. Production continues at a good rate.

An agreement has, apparently, been reached in the long drawn-out strike in the Tuscarawas district in Ohio, which has been on over a year. A joint conference has averaged a scale, on which the miners are now voting. The settlement is a compromise. The operators insisted on a scale 6⅛c. lower than that proposed by the miners. The scale now agreed to provides for a reduction from the miners' demand of 3½c. in the wide work, chain machine, and 3¼c. in the narrow work. The punching-machine scale shows a reduction of 3.44c. for wide work and 3.55c. for narrow work. Under the agreement the prices will be: Chain machine, wide work, 18¼c. a ton; loading, 56c.; narrow work, 22½c.; loading, 66c.; punching machine, wide work, 25⅛c.; loading, 54c.; narrow work, 29⅛c.; loading, 64 cents.

Coal Traffic Notes

Coal and coke tonnage of Virginian railway, 10 months of fiscal year, from July 1 to April 30, short tons:

	Commercial	Company	Total
Coal	1,720,408	147,051	1,867,459
Coke	10,538	.....	10,538
Total	1,730,946	147,051	1,877,997
Total, 1909-10	808,829	.....	808,829

Company coal was not included in the reports last year. For the four months ended April 30, the tonnage was 485,366 in 1910, and 766,231 in 1911; increase, 280,865 tons.

Coal tonnage of Monongahela River Consolidated Company, six months of fiscal year from Nov. 1 to April 30, short tons:

	1909-10	1910-11	Changes	
River coal	2,158,047	2,757,969	I.	599,922
Rail coal	1,017,061	890,408	D.	126,653
Total	3,175,108	3,648,377	I.	473,269

The total increase this year was 15.2 per cent.

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

Coal tonnage originating on lines of Southern railway, three months ended March 31: Tennessee district, 298,250; Alabama district, 671,846; total, 970,096 short tons, a decrease of 110,115 tons, or 10.2 per cent. from last year.

New York

Anthracite

June 7—The trade is settling down to its usual summer gait. Shipments from mines are large, but those to Buffalo for the Lake trade have been light so far. Steam sizes are in good supply.

Schedule prices for domestic sizes for June are $4.45 for lump, $4.70 for egg and stove and $4.95 for chestnut, all f.o.b. New York harbor. On steam sizes quotations are: Pea, $3@3.25; buckwheat, $2.30@2.75; No. 2 buckwheat or rice, $1.80@2.25; barley, $1.45@1.70; all according to quality, f.o.b. New York harbor.

Bituminous

The soft-coal market continues dull, especially as to harbor trade. Coastwise trade is beginning to wake up a little, and all-rail trade is fair. Contracts continue to be closed, most of them at 10c. or so under last year's figures.

Both West Virginia and Pennsylvania mines are limiting shipments, so that there is not much floating coal to worry the market, and stocks at tide are small.

Prices run about the same. A fair Miller vein steam coal can be had at $2.50, f.o.b. New York harbor. Lower grades sell down to $2.30, and better up to $2.85. Gas coals are $1.10 for ¾-in. at mines, $1 for run-of-mine and 75@85c. for slack.

Fogs and wind have bothered the coastwise trade a little, but vessels are plenty and rates about the same. From Philadelphia large boats get 60@70c. to Boston and Portland. From New York going rates are 55@60c. to Boston and Portland, with 10c. more to the shoal-water ports; 35@40c. to Providence and New Bedford; 25@30c. to Sound ports. From Hampton Roads to Boston, 65@70c. is asked.

Birmingham

June 5—Several orders for coal in large amounts are being figured on by Alabama coal operators with prospects of the business being secured for the coming fall or late summer. The trade right now is a little slack, a little better than half normal condition. So confident are the producers in Alabama, though, as to an early improvement that every effort is being made to hold the labor in this section.

Despite the quiet coal market no concessions in price have been made, so far as can be learned. Some of the smaller operators have been heard to say that recently orders were received that will keep them busy for a while.

The railroads are furnishing all the cars needed. The railroad consumption of coal is not very great right now.

The coke-market situation remains rather dull. The make has been reduced.

Chicago

June 5—The coal market remains quiet, buying for both steam and domestic uses being small, and supplies being kept down so that there is little price cutting. For steam uses the only active coal is Western screenings, lump and run-of-mine being decidedly dull. Even steam coals are becoming much less in demand, while domestic buying, except of anthracite, is very slight. Summer conditions are affecting nearly all the trade, and a revival of activity can hardly be looked for until cool weather comes again. The unexpected, of course, may happen in steam demands, but potential supply is so greatly in excess of needs now that it is safe to say prices are not likely to rise.

Illinois and Indiana coals bring $1.90@2.30 for lump, $1.70@1.90 for run-of-mine and $1.65@1.85 for screenings, on cars. Smokeless is in light demand but is not so demoralized as a few weeks ago because it is not shipped so freely; it sells nearly up to circular prices of $3.55 for lump and egg and $3.15 for run-of-mine. Hocking is in better demand though not booming, at $3.15. Anthracite sales are better than usual for the first week in June, but small in comparison with sales a week or two ago.

Cleveland

June 5—Lake shipments are improving. A number of charters have been closed, and loading begun. Coal is being taken at 30c. to Milwaukee, a reduction from last season. Steam coal trade seems to be improving locally.

Middle district coal, f.o.b. Cleveland, is quoted at $2.15 for 1¼-in., $1.90 for ¾-

in., $1.80 for run-of-mine and $1.55@1.60 for slack. No. 8 and Cambridge district 5 or 10c. higher.

Pittsburg

June 6—The coal trade has slackened further, the Lake movement being light while there is little local demand. Mines are running at an average of less than 50 per cent. We continue to quote: Nut, $1.05@1.15; mine-run, $1.10@1.15; ¾-in., $1.20@1.25; 1¼-in., $1.30@1.35; slack, 75c. per ton at mine.

Connellsville Coke—Official confirmation has been given of the deal referred to in the last report as having been consummated between the Pittsburg Coal Company and the United States Steel Corporation. The confirmation appears to refer only to the portion of the deal made directly with the Pittsburg Coal Company, but it is believed that the deal with the Monongahela River Consolidated Company has also gone through. The Steel Corporation buys from the Pittsburg Coal Company its entire holdings in the Connellsville region, 7200 acres of coking-coal land, with 956 ovens, the price being about $1700 per acre, with the ovens and other improvements thrown in. Only a small part of the property was developed, since accordcording to the accepted practice in the region there should be an oven for two acres of coal, this promising exhaustion in 20 years, at full operation, or in 25 years with an allowance for stoppages. Thus about 5000 acres could be regarded as entirely undeveloped. The coke properties were owned by the Colonial Coke Company, controlled absolutely by the Pittsburg Coal Company. The Monongahela River Consolidated, which the Pittsburg Coal Company controls by ownership of stock, is understood to be selling the Steel Corporation between 8000 and 9000 acres of coal land across the Monongahela river from the Jones & Laughlin holdings, at about $800 an acre. Thus the total purchases involve about $18,000,000, effected by the issue of bonds on the properties, guaranteed by the Steel Corporation. These bonds will be held and marketed by the Union Trust Company, of Pittsburg, the cash being turned over to the sellers. The deal ought to put the Pittsburg Coal Company in very comfortable financial circumstances, reducing its floating debt and increasing its earnings, since there is no doubt that the saving in interest on bonds which can be retired will very much more than make up for the profits which have been earned on the coke operations. These profits, as a matter of fact, have been very light in recent years.

There is no reason to expect the coke market to be materially benefited, in the long run, by this sale, since the Steel Corporation in accordance with its policy established years ago, will not put any of the coke on the market. The Colonial company has been rather a free seller in the open market for the past two or three years, following the definite policy of operating full and selling the surplus coke, beyond its term contracts, at whatever it would bring. Its capacity is between 55,000 and 60,000 tons a month, and the removal of such a tonnage from the market will have an important effect in case any considerable demand develops. A careful comparison of coke-making and blast-furnace capacity at this time would indicate that, should it be desired to run the blast furnaces of the country full, not enough coke could be found for them. The contingency is remote, but it is of market importance that the industry has drifted into this alinement.

There has been nothing done in coke in the past week. We continue to quote the market nominally as follows: Prompt furnace, $1.50@1.55; contract, $1.75@1.85; prompt foundry, $1.90@2; contract foundry, $2@2.25, at ovens.

The *Courier* reports production in the Connellsville and lower Connellsville region in the week ended May 27 at 270,749 tons, a drop of 3000 tons, and shipments at 3006 cars to Pittsburg, 5233 cars to points west and 478 cars to points east, a total of 8717 cars.

St. Louis

June 5—The weather has been so oppressively hot during the last week that dealers have paid very little attention to the coal business. There is very little doing in the line of carload contracts though the steam coal men have been out soliciting business hard for some time. Wagonload contracts have been exceedingly disappointing. Lower prices have been made this year then ever before in the history of the trade and considering that the cost of production at the mine has advanced at least 10c. per ton, it is hard to see how certain prices can be made. Some wagonload contracts on Standard lump have gone as low as $1 .75 per ton, delivered. The minimum contract price on 2-in. lump is $1 at the mine. The freight rate is 52c. That leaves 23c. per ton to cover hauling, office expense and profit. It is generally conceded that the average haul costs 35c. per ton under the best conditions. The coal passes over the city scales. It is certainly a problem where the profit on this kind of business comes in.

Steam plants seem to be doing fairly well and quite a bit of coal is moving to the various industries. Screenings are firm and are readily bringing 75c. per ton which has been the prevailing price for 60 days at least. A number of plants who have been running full now have announced their intention to shut down on June 15 for their annual overhauling and inventory.

Current prices of coal in the St. Louis market are as follows:

	F.O.B. Mine	F.O.B. St.Louis
Standard:		
6-inch lump	$0.85	$1.27
2-inch lump	0.75	1.17
2-inch screenings	0.75	1.17
Mine run	0.75	1.17
2-inch nut	0.85	1.27
Staunton and Mt. Olive:		
6-inch lump	1.30	1.82
2-inch lump	1.25	1.77
2-inch screenings	0.75	1.17
2-inch nut	0.90	1.42
Carterville:		
6-inch lump or egg	1.15	1.82
3x2-inch nut	1.05	1.72
2-inch screenings	0.75	1.42
Trenton:		
6-inch lump or egg	1.75	2.27
3x2-inch nut	1.50	2.02
Franklin County:		
6-inch lump or egg	1.40	2.07
3x2-inch nut	1.20	1.87
Pennsylvania Anthracite:		
Chestnut		6.90
Stove or egg		6.65
Grate		6.40
West Virginia Smokeless:		
Lump or egg	1.50	4.00
Mine-run	1.10	3.60

East St. Louis prices are 20c. per ton lower on Illinois soft coal.

Anthracite—This market has slowed up though the movement of coal continues to be quite good. Shipments are still slow though they are catching up rapidly now.

FOREIGN·COAL·TRADE

Nova Scotia Coal—Shipments of coal from Nova Scotia mines, four months ended April 30, long tons:

Company:	1910	1911	Changes	
Dominion	710,127	804,028	I.	93,901
Nova Scotia Steel	160,665	108,469	D.	52,196
Acadia	83,479	125,482	I.	42,003
Intercolonial	79,983	83,837	I.	3,854
Inverness	71,380	76,475	I.	5,095
Total	1,105,634	1,198,291	I.	92,657

The total increase this year was 8.4 per cent.

French Foreign Trade—Imports and exports of fuel in France, three months ended March 31, metric tons:

	Imports	Exports	Excess	
Coal	4,321,400	301,207	Imp.	4,020,193
Coke	652,800	46,752	Imp.	606,048
Briquets	299,400	25,551	Imp.	273,849
Total	5,273,600	373,510	Imp.	4,900,090
Total, 1910	4,202,414	377,574	Imp.	3,824,840

Increase in imports, 1,071,186 tons; decrease in exports, 4064 tons. Exports this year include 32,377 tons coal and 11,341 tons briquets furnished to steamships in foreign trade.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report prices of coal on May 26, as follows: Best Welsh steam coal, $4.26; seconds, $4.02; thirds, $3.90; dry coals, $3.84; best Monmouthshire, $3.72; seconds, $3.54; best small steam coal, $2.52; seconds, $2.28. All prices are per long ton, f.o.b. shipping port, cash in 30 days, less 2½ per cent. discount.

IRON·TRADE·REVIEW

New York, June 7—The iron and steel markets have not yet shown much change. They may be said to be still waiting for further developments, and so far the reductions in steel prices have had little effect.

In pig iron there has been little business on an important scale. Buying in seaboard territory has been confined mainly to small orders for early delivery. Alabama and Virginia furnaces continue to press for business at the lower prices lately offered. Northern furnaces are inclined to meet this competition to some extent, but are not much inclined to press sales. In the Central West there have been inquiries for basic iron, but not much business closed. Foundry iron is quiet.

In finished material structural steel is still the leader. Other lines are rather quiet, at least in a large way, though there is some small business going. Buyers seem to think that more reductions are in order, and do not want to commit themselves until they believe the bottom has been reached. It is the opinion of some, however, that a turn will come next month when there will be more certainty as to the outcome of the crops. Jobbers report improvement in sales of small building material.

Pig Iron Production—Reports of the blast furnaces collected and published by the *Iron Age* and the *Iron Trade Review* show that on June 1 there were 207 coke and anthracite stacks in blast, against 220 on May 1. Making allowance for the charcoal furnaces, the estimated production of pig iron in the United States in May was 1,886,500 long tons, or 205,000 tons less than in April. For the five months ended May 31 the total was 9,806,200 tons.

Baltimore

June 5—Exports for the week included 2355 tons steel rails and 146 tons rail joints to Rosario, Argentina; 123 tons steel rails to Felton, Cuba; 3,370,227 lb. structural steel and 1,905,332 lb. miscellaneous iron and steel to Panama. Imports 3800 tons spiegeleisen and 2750 tons ferromanganese from Great Britain; 1285 tons spiegeleisen from Germany; 23,000 tons iron ore from Cuba.

Birmingham

June 5—Southern pig-iron manufacturers are not happy over the market situation. There are very few sales being made right now, and the fact that some producers or brokers are making concessions on the price, $10.50@10.75, for No. 2, foundry, does not appear to be inducing much trade. There is a large quantity of iron in the furnace and warrant yards and the needs for the balance of the year will be met without the blowing in of additional furnaces. The iron-makers which are going are still doing well. Unless there is a better demand for iron it will be necessary to shut down some more furnaces in the near future. There were some indications noted of preparations looking to a resumption of operations at furnaces; ore mines being started up, but as far as can be learned there will be no increase in the make until considerable of the iron on hand has been worked off and the demand is improved. A furnace or two will be lighted in the next two weeks or so but it is positively announced that where one starts up another will be blown out for repairs. It is possible that the make of basic iron may have to be increased a little in this territory as preparations are on for a resumption of operations at the big steel plant of the Tennessee company.

Official announcement is made by President Crawford of the Tennessee company that the steel and rail mills at Ensley will resume operations June 21. A deal is about consummated whereby the Dimmick Pipe Company plant at North Birmingham will resume operations July 1, after several months shutdown because of financial straits.

Chicago

June 5—Sales of pig iron are still light and there has yet been no general effect upon the market for iron and steel product from the cuts in prices recently announced. The impression of buyers seems to be that this is only a beginning and that it will be well for them to hold off as long as possible. In the pig-iron market this feeling has been apparent for several weeks. It has kept melters from buying in any large lots and today the tendency is to refrain from buying for delivery farther away than the end of the third quarter. Last-half needs cause a good many inquiries, showing that the melters are watching the market, but there are few sales. On such iron as is being sold prices are uncertain. Southern No. 2 foundry is quoted at $10.75@11, Birmingham, or $15.10@15.35, Chicago, but some is said to have sold at $10.50, Birmingham. Northern No. 2 sells for $14.50@15, with the market held nearly steady through large reductions in output and the steady demand for iron for special uses. General foundry business, on which this market so largely depends, is, it must be confessed, very dull and shows no indications of speedily becoming better. Coke is dull with Connellsville at $4.75, Chicago.

Cleveland

June 5—Ore trade is still rather slow and not much improvement is expected before the middle of June. A number of vessels are still tied up.

Pig Iron—The market is dull, with no change in prices.

Finished Material—Local buyers are hesitating and some are looking for more reductions. Those made have not started much new business so far.

Philadelphia

June 7—All kinds of iron continue dull, owing to two or three causes: First, to the fact that most consumers have some iron on hand or under contract for delivery; second, new business is coming in very slowly; third, concessions in prices are regarded as probable. Another influence might be added, namely, that Southern and especially Virginia irons are being pushed into every possible place where a sale can be made. Some special inducements have been offered by Southern makers to tempt late-delivery orders. Until there is a settlement of pig-iron prices and conditions large orders for either early or late delivery will be the exception. No. 2X foundry hangs around $15.50, for Northern, with $14.75 for forge. Basic is quoted at $15, with rumors of offers of liberal concessions.

Steel Billets—Open-hearth billets are quoted at $23.50, forging billets at $28.40, tidewater.

Bars—Refined iron is quoted at 1.27½@1.32½c., with steel bars strong at 1.40c. The cut prices have not brought out any business worth speaking of.

Sheets—Only scattered orders have been reported for the week. Quotations, 2.30c. at mill.

Pipes and Tubes—Some delayed business that has been hanging fire has just been captured by certain rumored concessions, the extent of which is unknown.

Plates—Very little new business has been closed in plates. Plates are quoted at 1.50c. and upward according to thickness.

Structural Material—For some reason or other a good deal of business that was virtually closed has been held up. Manufacturers say that while the situation has been disturbed by changes and shadings in prices that the situation has improved and an encouraging volume of business is very near at hand.

Scrap—A week of dullness has passed, very little business having been done outside of railroad scrap, which met with better luck this week than for several weeks past.

Pittsburg

June 6—It is practically a week since the formal cuts were made in finished steel products and it is not possible as yet to gage accurately the results. In general the steel trade has been more stagnant than formerly, a development which would hardly have been considered possible, but in sheets considerable business has developed.

There have been additional bookings of steel-bar contracts since Republic's

cut, and altogether perhaps 75,000 to 100,000 tons have been booked on this entire movement. At the outside limit mentioned, however, the tonnage compares unfavorably with what would be expected at this season of the year. No definite tendency has been developed to shade the new prices, and the controlled market is practically as much in evidence as before Republic's withdrawal. This withdrawal, it appears, was only formal, to give the company a free hand in cutting prices should it desire. As a matter of fact, it does not appear to have made any cuts beyond those openly announced at the beginning, nor is there any particular likelihood that it will.

Pig Iron—There appear to be no sellers of basic at less than $13.25, Valley, and we quote this as the market. The $13.10 sales on which the quotations in last two reports were based were made by scrap dealers who had taken a total of about 2000 tons of basic iron from the Pittsburg Crucible Steel Company, Midland furnace, in exchange for scrap, the terms being that the dealers were to take the iron as fast as made, to save the producer the expense of piling, and the scrap dealers had to make special prices. Since then it has not developed that others are ready to sell at the figure, and a return to $13.25 as the market quotation seems to be dictated by the conditions. Bessemer has been very quiet. Sales of foundry iron are somewhat more numerous, on the basis of $13.75, Valley, for No. 2, which is the going price. Large consumers believe they could break this price on a large purchase, but do not wish to do so, so the market drags. We quote, f.o.b. Valley furnaces, 90c. higher delivered Pittsburg: Bessemer, $15; basic, $13.25; No. 2 foundry, $13.75; gray forge, $13.25; malleable, $13.25@13.50, depending on analysis. The pig-iron averages, compiled from actual sales, are announced for May at $15, Valley, for bessemer and $13.40 for basic.

Ferromanganese—A sale of 2000 tons is reported at about $36.50, Baltimore, the market otherwise being quiet; we quote prompt and forward at $36.50, Baltimore.

Steel—Reports are that specifications on sheet-bar contracts have slightly improved in the past few days, but there is no new buying of any unfinished steel. We quote billets at $21 and sheet bars at $22, f.o.b. maker's mill, Pittsburg or Youngstown, in accordance with the $2 reduction noted in last report, and wire rods unchanged at $29, Pittsburg.

Sheets—As noted, demand for sheets appears to have improved somewhat in the past few days. There has been no shading of the new prices, which leave practically no margin at all for the mills which must buy their steel. Black and galvanized sheets were reduced $4 a ton, while sheet bars were reduced $2. There had been shading in the sheet market, the extreme shading generally not exceeding $2 a ton, so that the readjustment equalized the market, and there is reason to believe it removed any margin by which sheet mills buying their steel could shade further. We quote: Black sheets, 28 gage, 2c.; galvanized, 3c.; blue annealed, 10 gage, 1.50c.; painted corrugated roofing, 28 gage, $1.40 per square; galvanized, $2.55 per square. The reductions in corrugated, 28 gage, were 15c. and 20c. respectively, differentials between gages being revised, so that the reduction per square follow quite closely the reduction of $4 a ton on flat sheets, which was made uniformly on all gages.

St. Louis

June 5—The recent cuts in prices of finished steel have not had a beneficial effect on the pig-iron market. It is the general opinion of buyers that there will be reductions all down the line on all iron and steel products and that prices will reach a lower level. Southern pig is now quoted at $10.50, Birmingham, or $14.25, St. Louis, for No. 2 foundry. This price does not seem to arouse buyers as the orders are light and for small quantities.

METAL MARKETS

New York, June 7—The metal markets continued rather quiet and without special incident during the week.

Owing to a slight mistake in transcribing, the average price of electrolytic copper in May, stated last week, was incorrect. It should be 11.990c., instead of 11.992c., as given.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
April 1911..	$1,505,634	$ 4,524,835	Imp.$ 3,019,201
" 1910..	36,283,625	2,100,918	Exp. 34,182,707
Year 1911..	3,359,658	23,990,572	Imp. 20,630,914
" 1910..	47,275,749	13,499,276	Exp. 33,776,473
Silver:			
April 1911..	7,610,154	4,251,532	Exp. 3,358,622
" 1910..	4,696,534	3,840,495	" 856,039
Year 1911..	23,611,196	14,998,313	" 8,612,883
" 1910..	18,336,083	15,238,634	" 3,097,449

Exports from the port of New York, week ended June 3: Gold, $264,125, chiefly to Panama; silver, $793,314, principally to London and Paris. Imports: Gold, $896,479, nearly all from Mexico; silver, $14,356, in small lots.

Gold—The price of gold on the open market in London continued at the usual level, 77s. 9d. per oz. for bars and 76s. 4½d. per oz. for American coin. There was no special demand. In New York there is some talk of gold imports, but none have been made yet.

Platinum—The market continues steady with a quiet tendency. Dealers ask $43 per oz. for refined platinum and $45.50 for hard metal.

Silver—The market continues very steady. Fluctuations are confined within a small compass. The stocks in Bombay show quite a reduction; and the latest reports quote about 13,600 bars.

SILVER AND STERLING EXCHANGE

June	1	2	3	5	6	7
New York....	53¼	53⅜	53⅜	53⅜	53⅛	53¼
London.....	24⅞	24⅞	24⅝	....	24½	24⅞
Sterling Ex..	4.8610	4.8600	4.8585	4.8580	4.8590	4.8580

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper, Tin, Lead and Zinc

NEW YORK

June	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
1	12¼ @12⅜	12.05 @12.15	46¼	4.35 4.37½	4.20 @4.22½	5.32½ @5.37½	5.17½ @5 22½
2	12¼ @12⅜	12.05 @12.15	46¼	4.35 4 37½	4.20 @4.22½	5.32½ @5.37½	5.17½ @5.22½
3	12¼ @12⅜	12.05 @12.15	46¼	4.35 4.37½	4.20 @4.22½	5.32½ @5.37½	5.17½ @5.22½
5	12⅜ @12½	12.10 @12.20	47	4.35 4.37½	4.20 @4.22½	5.32½ @5.37½	5.17½ @5.22½
6	12¾ @12½	12.15 @12.20	47	4.35 4.37½	4.20 @4.22½	5.32½ @5.37½	5.17½ @5.22½
7	12¾ @12½	12.15 @12.25	46	4.35 4.37½	4.20 @4.22½	5.32½ @5.35	5.17½ @5.22½

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

June	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
1	55 1/16	55⅝	59¼	214	190½	13⅜	24½
2	54⅛	55¾	59¼	215	191	13 1/16	24½
3	.....	.....	.....	.....	.....	.....	.....
5	.....	.....	.....	.....	.....	.....	.....
6	55 5/16	56	59¼	215	192¾	13⅜	24½
7	55 5/16	56	59½	209	192¾	13⅜	24½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The market here continues quiet and domestic consumers are disinclined to cover their requirements except against current orders. Europe is taking a much more sanguine view of the copper situation. Buying for export has been heavy throughout the week, and a particularly heavy demand developed since the opening of the London

Metal Exchange subsequent to the Whitsuntide holiday. Sellers, in consequence, were able to relieve their position to such an extent that they could afford gradually to raise their prices, while some interests that heretofore have been insistent sellers were content to stand aloof. At the close there was but little copper offered at better than 12⅜c., delivered, usual terms. The business in Lake copper has been less active than in electrolytic. The leading sellers raised their price to 12½c., and 12⅜c. is bid by domestic consumers. The close is firm at 12⅜@12½c. for Lake copper, and 12.15@12.25c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 12.05 @12.15c. as the average for the week.

The London standard market displayed more activity, and a fair amount of speculation is reported for the rise, resulting in a slow but stubborn advance, which at the close brings spot option up to £55 8s. 9d., and three months' option to £56 per ton.

Copper sheets are 18@19c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 13¾c. base, carload lots at mill. Business is very quiet.

Tin—After the Banka sale, which took place on May 31, the London market continued its vigorous advance. It would be idle to try to prognosticate the course of the market at this time. It is so absolutely dominated by the Syndicate that it entirely rests with them to engineer an advance or decline. The close today (June 7) shows a severe decline from the opening, and the market is cabled as weak at £209 for spot, and £192 15s. for three months.

Buyers in the domestic market necessarily are very cautious, and while some business in future tin has been done, spot material is bought only when absolutely needed. The latter is again becoming very scarce and held at a high premium. The market for June tin may be quoted nominally at about 46 cents.

Visible stocks of tin on June 1, including tin afloat: London, 10,058; Holland, 2725; United States, excluding Pacific ports, 3155; total, 15,938 long tons, an increase of 1497 tons over the May 1 report.

Lead—Business has been on a somewhat heavier scale, but the demand was freely met at current quotations, the close being unchanged at 4.20@4.22½c. St. Louis, and 4.35@4.37½c. New York.

The London market has been able to maintain practically all of its recent advance, and closes steady at £13 2s. 6d. for Spanish lead, and £13 5s. for English.

Spelter—While there has been a somewhat better inquiry, and a fairly large tonnage has been sold at 5.20, business is still far from normal, a situation that is readily explained by the deadlock existing in the markets for iron and steel products. However, the spelter market is without doubt in a strong position and ripe for an upward movement if increased demand should develop. The relatively low price that has lately been prevailing is explainable by the policy of some smelters to sell right along against their ore purchases and be content with the substantial margin that now exists. The close is steady at 5.17½@5.22½c. St. Louis, and 5.32½@5.37½c. New York.

The London market closes unchanged at £24 10s. for good ordinaries and £24 15s. for specials.

Zinc dust has been sold this week at 6½@6¾c., duty paid.

Base price of zinc sheets $7.25 per 100 lb., f.o.b. La Salle-Peru, less 8 per cent. discount.

Other Metals

Aluminum—The market is still quiet, with few transactions. Quotations are lower, at 19¼@20¼c. per lb. for No. 1 ingots.

Antimony—The market is heavy and prices are off, though sales have reached a fair amount. Cookson's can now be had at 9c. per lb., while 7.30@7.60c. is named for Hungarian, Chinese and other outside brands.

Quicksilver—There is no change in the situation, and spot supplies are still rather scarce. Prices are unchanged. At New York sales are made at $43, to arrive, per flask of 75 lb. In San Francisco $42.50 is quoted for domestic orders and $40 for export. The London price is £8 5s. per flask, with £7 15s. quoted from second hands.

Imports and Exports of Metals

Exports and imports of metals in the United States, four months ended April 30, are reported as follows, in the measures usual in the trade:

Metals:	Exports	Imports	Excess
Copper, long tons	107,634	51,664	Exp. 55,970
Copper, 1910....	85,714	49,814	Exp. 35,900
Tin, long tons....	163	18,927	Imp. 18,764
Tin, 1910.....	202	18,075	Imp. 17,873
Lead, short tons.	26,821	32,563	Imp. 5,742
Lead, 1910.....	16,465	36,070	Imp. 19,605
Spelter, sh. tons.	2,507	810	Exp. 1,697
Spelter, 1910....	501	1,120	Imp. 619
Nickel, lb.....	7,669,631	9,241,852	Imp. 1,572,221
Nickel, 1910....	5,028,963	11,876,487	Imp. 6,847,524
Antimony, lb.....	150,704	2,923,125	Imp. 2,772,421
Antimony, 1910.	551	3,192,376	Imp. 3,191,825
Platinum, oz.....	47	30,764	Imp. 30,717
Platinum, 1910.	47	36,303	Imp. 36,256
Aluminum, value	$435,082	.....	Exp. $435,082
Aluminum, 1910	142,681	.....	Exp. 142,681
Ores, etc.:			
Zinc oxide, lb..	9,033,137	.....	Exp. 9,033,137
Zinc oxide, '10..	9,191,843	.....	Exp. 9,191,843
Zinc dross, lb....	1,541,837	.....	Exp. 1,541,837
Zinc dross, '10..	2,028,790	.....	Exp. 2,028,790
Zinc ores, lg.tons	5,789	18,748	Imp. 12,959
Zinc ores, 1910.	7,515	23,379	Imp. 15,864
Chrome ore, tons	.....	11,479	Imp. 11,479
Chrome ore, '10	20	12,706	Imp. 12,686

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Imports of aluminum are not given. The exports given above include reëxports of foreign material. Zinc contents of ores imported were 17,745,416 lb. in 1910, and 12,367,508 lb. this year.

Zinc and Lead Ore Markets

Platteville, Wis., June 3—The base price paid this week for 60 per cent. zinc ore was $39. The base price paid for 80 per cent. lead ore was $54 per ton.

SHIPMENTS, WEEK ENDED JUNE 3

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point.....	762,820	.....	.....
Galena.....	662,200	.....	.....
Platteville.....	497,370	88,000	306,100
Hazel Green.....	412,540	.....	.....
Benton.....	316,300	48,100	162,400
Harker.....	312,710	.....	.....
Highland.....	227,600	76,400	.....
Rewey.....	128,000	.....	.....
Cuba City.....	88,000	.....	227,000
Linden.....	56,730	.....	.....
Shullsburg.....	.....	77,000	.....
Total.....	3,464,270	289,500	695,500
Year to date.....	60,546,640	3,787,325	14,777,290

Shipped during week from separating plants, 2,505,970 lb. zinc ore.

Joplin, Mo., June 3—The highest price paid for zinc sulphide ore was $43, the base ranging from $37 to $40 per ton of 60 per cent. zinc. Zinc silicate sold

SHIPMENTS, WEEK ENDED JUNE 3

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,098,480	.....	819,260	$96,201
Joplin.....	1,902,280	.....	251,310	44,444
Galena.....	853,380	.....	143,290	20,155
Alba-Neck....	633,700	.....	43,380	13,845
Granby.....	124,150	480,550	32,000	9,170
Duenweg.....	311,870	217,750	.....	8,538
Spring City..	134,740	122,920	107,890	6,612
Oronogo.....	361,540	.....	.....	6,453
Miami.....	323,230	.....	65,920	5,695
Aurora.....	258,610	65,590	.....	5,312
Carl Junction	222,860	.....	.....	4,568
Quapaw.....	98,470	.....	80,140	3,789
Badger.....	137,530	.....	.....	2,444
Jackson.....	88,280	.....	.....	1,741
Carthage.....	66,140	.....	.....	1,256
Totals.....	9,615,260	886,810	1,543,190	$230,223
22 weeks....	217,589,810	14,247,330	37,054,730	$5,469,904
Blende val., the week,	$177,374;	22 weeks,		$4,273,016
Calamine, the week,	10,689;	22 weeks,		167,246
Lead value, the week,	42,160;	22 weeks,		1,029,642

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1910	1911	1910	1911	1910	1911
January.....	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February....	40.69	40.21	39.47	39.16	53.64	54.46
March.....	43.60	39.85	39.71	38.45	51.26	54.77
April.....	41.00	38.88	39.33	37.47	49.72	56.37
May.....	40.19	38.25	37.51	36.79	48.16	55.21
June.....	40.20	.....	37.83	.....	48.80	.....
July.....	39.63	.....	36.80	.....	48.59	.....
August.....	40.13	.....	37.32	.....	49.75	.....
September..	43.45	.....	39.96	.....	54.73	.....
October.....	43.31	.....	40.50	.....	53.18	.....
November...	47.20	.....	43.20	.....	54.80	.....
December...	42.50	.....	40.70	.....	55.70	.....
Year.....	$42.43	.....	$39.79	.....	$52.12	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

at $25 high, on a base of $19@21 per ton of 40 per cent. zinc. The average price, all grades of zinc ore, was $35.80 per ton.

The highest price paid for lead ore was $56.50, medium grades selling generally at $55, with some lower grades at $54. The average price, all grades of lead ore, was $54.64 per ton.

The week opened with promise for active competition in the zinc-ore market, with a strong demand at prices a shade higher than the close of last week. Orders were generally for large purchases and a large shipment. Thursday's wires brought orders to practically all buyers to cut down purchases as close as possible, and yet the shipment was as large as last week.

All efforts to revive the producers' association have so far met with little encouragement from the larger number of operators. Some are favoring the old-time club idea, from which better results were secured.

New Caledonia Ores

Exports of nickel ore from New Caledonia, for three months ended March 31, are reported by the *Bulletin de Commerce*, of Noumea, at 29,432 metric tons. Exports of metals were 225 tons nickel matte and 206 tons copper matte.

CHEMICALS

New York, June 7—The general market remains quiet for the most part, with few changes.

Imports and Exports—Imports and exports of chemicals and raw material in the United States, four months eided April 20:

	Imports	Exports	Excess
Copper sulph. lb.	.....	5,410,875 E.	5,410,875
Copper sul., '10	.....	2,757,410 E.	2,757,410
Bleach, lb.	33,093,400	17,368 I.	33,076,032
Bleach, 1910	32,950,172	..... I.	32,950,172
Potash salts, lb.	310,908,547	1,445,638 I.	309,462,909
Potash salts, '10	231,298,372	1,946,256 I.	229,352,116
Soda salts, lb.	13,228,260	192,430 I.	13,035,830
Soda salts, 1910	13,601,487	176,993 I.	13,424,494
Acetate lime, lb.	.....	27,507,151 E.	27,507,151
Acetate, 1910	.....	23,456,327 E.	23,456,327
Nit. of soda, tons	225,375	2,716 I.	222,659
Nitrate, 1910	184,113	2,608 I.	181,505
Phosphates, tons	.....	354,752 E.	354,752
Phosphates, '10	.....	324,807 E.	324,807
Sulphur, tons	7,303	647 I.	6,656
Sulphur, 1910	11,742	14,218 E.	2,476
Pyrites, tons	304,041	..... I.	304,041
Pyrites, 1910	142,511	..... I.	142,511
Magnesite, lb.	101,654,432	923,550 I.	100,730,882
Magnesite, 1910	87,649,914	1,621,792 I.	86,028,122
Sul. ammonia, lb.	88,011,199	..... I.	88,011,199
Sul. am'nia, '10	60,394,158	6,000 I.	60,388,158
Arsenic, lb.	1,613,143	..... I.	1,613,143
Arsenic, 1910	2,529,499	2,251 I.	2,527,248

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites, the total imports of sulphur this year were 128,919 tons.

Copper Sulphate—Supplies are again reported as better; but quotations remain at $4.50 per 100 lb. for carload lots.

Arsenic—The market remains dull, with demand hardly up to supply. Quotations are unchanged at $1.50@1.62½ per 100 lb. for white arsenic.

Nitrate of Soda—Business is slightly easier in this article and prices a shade off, 2.10c. per lb. being quoted for spot and 2.12½ for futures.

Messrs. Mortimer & Wisner, New York, report the position of nitrate in the United States on June 1 as follows, in long tons:

	1910	1911	Changes
Stocks, Jan. 1	14,000	12,790	D. 1,210
Imports, 5 mos	192,580	253,312	I. 60,732
Total supply	206,580	266,102	I. 59,522
Deliveries, 5 mos	198,980	250,522	I. 51,542
Stocks, June 1	7,600	15,580	I. 7,980
Afloat for U. S.	89,000	93,000	I. 4,000

Quantities afloat include all cargoes due to arrive at United States ports, by Sept. 15 next.

MINING·STOCKS $

New York, June 7—The general stock market has not been specially active. The anticipated lively bull movement has not yet developed.

The Curb market was also rather quiet, though no special weakness developed. Butte Coalition was the most active among the copper stocks, and made some gain in prices. Other mining shares were inclined to be slow.

At auction in New York, June 1, a lot of 22 shares United States Steel preferred brought $117.75 per share; $26,000 New Livingstone Coal Company first-mortgage bonds, $500 for the lot. A lot including 950 shares Northern Coal Company, Ltd., of New Brunswick; 39,936 shares Kent Coal Company, Ltd., of Maine; 44.875 shares Crown Coal Company, Ltd., of Maine; 24,950 shares Great Northern Coal Company, Ltd., of Nova Scotia; 41,201 shares Great Northern Coal Company, of Maine; 960 shares North Shore Railway Company, of New Brunswick, and claim to title in 49,950 shares Maritime Coal Company, Ltd., of Nova Scotia, brought $10,500 for the lot.

Boston, June 6—Copper shares continue to show strength and—outside of Copper Range—prices are all above a week ago. That stock has lost $3, going off to $60 on the reduction in the quarterly dividend rate from $1 to 75c. The deal to take over the Atlantic mine on the basis of exchanging one share for 10 Atlantic has gone through and the dividend will also go to the new stock.

Both North Butte and Calumet & Arizona stocks have been prominent and as these are Cole-Ryan companies their strength is considered significant. The Calumet & Hecla group continues neglected, although Isle Royale took a sharp spurt. There is some fear that the Calumet & Hecla merger will fail to go through, which would result in some of the subsidiary companies attaining higher prices than the present ones.

Old Dominion has been especially strong. Island Creek and U. S. Smelting stocks continue active, while Lake, North Lake and Indiana have also had active and strong periods. East Butte touched $14, its highest price for a long period.

On the Curb business has been of fair volume. Bohemia, New Baltic and South Lake have reflected the strength of the stocks in the big market. Rhode

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	March	April	May
Anaconda	21,900,000	21,500,000	.....
Arizona, Ltd.	3,094,000	2,840,000	.....
Balaklala	866,670	845,000	.....
Copper Queen	7,333,629	6,933,422	.....
Calumet & Ariz.	1,960,000	3,850,000	3,854,000
Detroit	1,914,710	1,814,740	.....
East Butte	1,120,000	1,085,000	.....
Imperial	.....	.....	.....
Nevada Con.	5,932,259	5,298,632	.....
Old Dominion	2,563,000	2,535,000	2,363,000
Shannon	1,322,000	1,258,000	.....
South Utah	300,007	300,137	.....
Superior & Pitts.†	2,540,000	.....	.....
United Verde*	3,000,000	2,500,000	.....
Utah Copper Co.	7,260,267	8,169,248	.....
Lake Superior*	20,000,000	16,000,000	.....
Non-rep. mines*	12,224,993	11,825,000	.....
Total production.	93,331,535	86,754,179	.....
Imports, bars, etc.	24,345,814	25,655,122	.....
Total blister	117,677,349	112,409,301	.....
Imp. in ore & matte	6,126,650	5,207,484	.....
Total	123,803,999	117,716,785	.....
Brit. Col. Cos.:			
British Col. Copper	804,542	.....	.....
Granby	1,988,341	.....	.....
Mexican Cos.:			
Boleo	2,700,880	2,403,520	.....
Cananea	3,542,000	3,644,000	4,098,000
Moctezuma	2,049,150	2,315,292	.....
Exports from:			
Chile	9,408,000	.....	.....
Australia	4,816,000	.....	.....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.
†From April the Superior & Pittsburg production is included with Calumet & Arizona.

STATISTICS OF COPPER

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries, for Export
V, 1910	123,242,476	59,305,222	45,495,400
VI	127,219,188	53,363,196	65,895,948
VII	118,370,003	56,708,175	59,407,167
VIII	127,803,618	67,731,271	61,831,780
IX	119,519,983	64,501,018	75,106,496
X	126,469,284	67,814,172	68,186,912
XI	119,353,463	60,801,992	67,424 316
XII	123,339,219	43,594,018	88,104,075
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	.....	.....	.....

	Visible Stocks.		
	United States.	Europe.	Total.
VI, 1910	160,425,973	239,142,400	399,568,378
VII	168,386,017	232,892,800	401,278,817
VIII	170,640,678	222,320,000	392,960,675
IX	168,881,245	218,444,800	387,326,046
X	148,793,714	211,276,800	360,070,519
XI	139,261,914	198,060,800	337,322,711
XII	130,389,069	193,200,000	323,589,095
I, 1911	122,030,195	236,629,120	358,649,373
II	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	.....	202,540,800	.....

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

Island Coal has also been an active feature.

Spokane, Wash.

June 1—Walter J. Nicholls has been elected president of the Spokane Mining Exchange. H. T. Irvine is vice-president and C. E. Mallette is secretary and treasurer.

Assessments

Company	Delinq	Sale	Amt
Caledonia, Nev	June 2	June 21	$0.10
Carney Copper, Ida	May 15	June 25	0.004
Clear Grit, Ida	June 9	July 6	0 002½
Con. Virginia, Nev	June 14	July 5	0.25
Copper King, Ida	May 15	June 15	0.01
Dennemora, Ida	June 26	July 26	0 002
East Hercules Extens'n, Id.	June 19	July 19	0.001
Ely Consolidated, Nev	May 2	June 22	0.05
Hypotheek, Ida	May 22	June 16	0.005
Imperial, Ida	May 17	June 17	0.005
Mass, Mich	June 15		2.00
Missoula Copper, Ida	June 5	July 19	0.01
Mountain Dell, Utah	May 31	June 16	0.02
New York-Bonanza, Utah	June 8	June 29	0 02
Nine Mile, Ida	June 25	July 30	0.001
North Star, Ida	May 15	June 15	0.001
Overman, Nev	May 17	June 7	0.05
Reindeer, Ida	June 1	July 1	0.005
Rockford, Ida	June 6	July 6	0.001
Silver Shield, Utah	May 16	June 3	0.015
Smuggler, Utah	May 20	June 20	0.005
Swansea Consolidated, Utah	May 15	June 7	0.01
Utah Consolidated, Utah	May 20	June 10	0.01
Utah United Copper, Utah	June 24		0.01
Wonderful, Ida	May 22	July 10	0.001
Yellow Jacket, Nev	May 8	June 8	0.10

Monthly Average Prices of Metals

SILVER

Month.	New York.			London.		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24 865
February	51.472	51.534	52 222	23.706	23.794	24.081
March	50.468	51.454	52 745	23.227	23.690	24.324
April	51.428	53.221	53 325	23 708	24.483	24 595
May	52.905	53.870	53.308	24.343	24.797	24.583
June	52.538	53.462		24.166	24.651	
July	51.043	54.150		23.519	25.034	
August	51.125	52.912		23.588	24.428	
September	51.440	53.295		23.743	24.567	
October	50.923	55.490		23.502	25.596	
November	50.703	55.635		23.351	25 680	
December	52.226	54.428		24.030	25.160	
Total	51.502	53.486		23.706	24.670	

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	New York.				London, Standard.	
	Electrolytic		Lake.			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12 295	13.870	12 680	60.923	55.604
February	13.332	12 256	13.719	12 611	59.388	54.970
March	13.255	12 139	13.586	12.447	59.214	54 704
April	12.733	12 019	13.091	12 275	57.238	54 035
May	12 550	11 990	12.885	12.214	56.313	54.313
June	12.404		12 798		55.310	
July	12.215		12 570		54.194	
August	12.490		12.715		55.733	
September	12 379		12 668		55.207	
October	12.553		12.788		56.722	
November	12 742		12 914		57 634	
December	12 581		12.863		56 769	
Year	12.738		13.039		57.054	

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

TIN AT NEW YORK

Month.	1910.	1911.	Month.	1910.	1911.
January	32.700	41.255	July	32 695	
February	32 920	41 614	August	33.972	
March	32.463	40.157	September	34 982	
April	32.976	42 185	October	36 190	
May	33.125	43.115	November	36 547	
June	32.769		December	38.199	
			Av. Year	34 123	

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis.		London.	
	1910.	1911	1910.	1911.	1910.	1911.
January	4.700	4 483	4.582	4 334	13.650	13.009
February	4.613	4 440	4.445	4 266	13.328	13.043
March	4.459	4.394	4.307	4 238	13.063	13 122
April	4.376	4 412	4.225	4 262	12 641	12 889
May	4.315	4.373	4.164	4.223	12.550	12.984
June	4.343		4.207		12.688	
July	4.404		4.291		12.531	
August	4.400		4.290		12.513	
September	4.400		4 289		12 582	
October	4.400		4.271		13.091	
November	4.442		4 314		13.217	
December	4.500		4.363		13 197	
Year	4.446		4.312		12.920	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5 452	5.951	5 302	23.350	23.887
February	5.569	5 518	5.419	5.368	23.188	23.276
March	5.637	5.563	5.487	5.413	23.031	23 016
April	5.439	5 399	5.289	5.249	22.469	23 743
May	5.191	5.348	5.041	5.198	22.100	24.375
June	5.128		4.978		22.094	
July	5.152		5.002		22.406	
August	5.279		5.129		22.800	
September	5.514		5.364		23.165	
October	5.628		5.478		23.900	
November	5 976		5 826		24 083	
December	5.624		5.474		24.019	
Year	5.520		5 370		23 050	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG.

	Bessemer		Basic		No. 2 Foundry	
	1910	1911	1910	1911	1910	1911
January	$19.90	$15 90	$17.98	$14 40	$17.94	$14 75
February	18.96	15 90	17.21	14 50	17.38	14.81
March	18.53	15.90	16.93	14 65	17.00	14.96
April	18 28	15 90	16.84	14.65	16.75	15.00
May	17.10	15.90	15.94	14.30	16.18	14.72
June	16.52		15.60		15.53	
July	16.40		15.40		15.40	
August	16 09		14.89		15.16	
September	15.92		14.73		14 93	
October	15.90		14.05		14 88	
November	15 84		14.26		14 78	
December	15 90		14.15		14.65	
Year	$17.10		$15.65		$15.83	

STOCK QUOTATIONS

COLO. SPRINGS June 6

Name of Comp.	Bid.
Acacia	.03½
Cripple Cr'k Con.	.01
C. K. & N.	.10
Doctor Jack Pot.	.05
Elkton Con	.57
El Paso	.52½
Findlay	.03
Gold Dollar	.10½
Gold Sovereign	‡.02½
Isabella	.10½
Jack Pot	.04½
Jennie Sample	.09½
Lexington	‡.01
Moon Anchor	.02½
Old Gold	.02½
Mary McKinney	.31
Pharmacist	‡.01
Portland	.90
Vindicator	.81
Work	‡.02

SALT LAKE June 6

Name of Comp.	Bid.
Beck Tunnel	.30
Black Jack	.14
Carisa	.15
Cedar Talisman	.07
Colorado Mining	.50
Columbus Con	.45
Daly Judge	4.45
Grand Central	.75
Iron Blossom	1.27½
Little Bell	.46
Lower Mammoth	.11½
Mason Valley	9.00
May Day	.15½
Nevada Hills	3.07½
New York	.12
Prince Con	.60
Silver King Coal'n	1.50
Sioux Con	.33½
Uncle Sam	.69
Yankee	.17½

TORONTO June 6

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6 25	Dome Exten	.57
Hudson Bay	.90	Pearl Lake	.54
Temiskaming	.68	Dobie	2 80
Wettlaufer-Lor	‡1 09	West Dome	2.00
Apex	.15	Standard	.15
Central	‡.73	Preston E. D	.31
Hollinger	12 50	Canada	‡1 12
Porcu. Gold	‡ .60	Rea	5 50
Porcu. Tisdale	.10½	Coronation	.20
Imperial	.15	Swastika	.50

SAN FRANCISCO June 6

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.06	Belmont	6.20
Belcher	‡.80	Jim Butler	.22
Best & Belcher	.42	MacNamara	.12
Caledonia	.54	Midway	.20
Challenge Con	.19	Mont.-Tonopah	‡.85
Chollar	.16	North Star	.14
Confidence	‡.90	West End Con	.50
Con. Virginia	1.10	Atlanta	.10
Crown Point	‡.75	Booth	.07
Gould & Curry	.23	C.O.D. Con	.08
Hale & Norcross	.22	Comb. Frac	.07
Mexican	3.72½	Jumbo Extension	.29
Occidental	.65	Oro	.04
Ophir	1.95	Silver Pick	.05
Overman	.54	St. Ives	.10
Potosi	.30	Tramps Con	‡.02
Savage	.28	Argonaut	‡1.70
Sierra Nevada	.58	Bunker Hill	‡7 12
Union Con	1 37½	Cent. Eureka	‡1.20
Yellow Jacket	.50	So. Eureka	‡7 00

N. Y. EXCH. June 6

Name of Comp.	Clg.
Amalgamated	67⅝
Am. Agri. Chem	58
Am.Sm.&Ref..com	80⅞
Am. Sm.& Ref., pf.	‡107¼
Anaconda	40
Batopilas Min	2.15
BethlehemSteelpf	63¾
Chino	23⅜
Comstock Tunnel	‡.29
Federal M.& S., pf.	60⅛
Goldfield Con	6⅛
Great Nor., ore ctf.	62½
Homestake	84½
Miami Copper	20¼
Nat'nalLead,com.	56¾
National Lead, pf.	107
Nev. Consol	19⅜
Pittsburg Coal, pf.	86¾
Ray Con	17½
RepublicI&S,com	30¼
Republic I & S, pf.	95
SlossSheffi'd,com.	‡49½
Sloss Sheffield, pf	‡112
Tennessee Copper	40
Utah Copper	47½
U. S. Steel, com	77⅛
U. S. Steel, pf	118½
Va. Car. Chem	53½

N. Y. CURB June 6

Name of Comp.	Clg.
Ariz.-Cananea	‡33⅛
Barnes King	‡.15
Braden Copper	4⅜
B. C. Copper	5¼
Buffalo Mines	‡2
Butte Coalition	19⅞
Calumet & Mont.	‡ 20
Cobalt Central	.05
Con. Ariz Sm	1⅛
Davis-Daly	1⅜
Ely Con	⅛
Florence	1⅛
Giroux	6⅞
Greene Cananea	7¼
Greenwater	.06
Guanajuato	‡3¼
Guerrero	‡1⅛
Guggen. Exp	200
Inspiration	8⅞
Internat. S. & R	124
Kerr Lake	5⅞
La Rose	4⅜
McKinley-Dar-Sa.	1½
Min. Co. of A. new	5⅜
Moneta Porc	.16
Mont Shoshone	‡.04
Nev. Utah M. & S.	⅜
Nipissing Mines	10½
Ohio Copper	1⅛
Pacific Sm. & M.	⅛
Precious Metals	‡⅛
Ray Central	1⅜
Red Warrior	‡1½
South Utah M.& S.	⅛
Standard Oil	651
Stewart	1½
Tonopah	5¾
Tonopah Ex	1.01
Tri-Bullion	½
Tularosa	‡½
Union Mines	⅛
Yukon Gold	3⅛

LONDON June 7

Name of Com.	Clg.
Camp Bird	£1 11s 9d
Dolores	1 10 0
El Oro	1 4 6
Esperanza	1 10 7½
Mexico Mines	0 8 5
Oroville	0 6 9
Stratton'sInd.	0 2 3
Tomboy	0 15 6

BOSTON EXCH. June 6

Name of Comp.	Clg.
Adventure	7
Algomah	9
Allouez	32
Am. Zinc	29
Arcadian	3⅛
Arizona Com	17¼
Atlantic	6
Bonanza	.70
Boston & Corbin	15¼
Butte & Balak	5
Calumet & Ariz	62½
Calumet & Hecla	475
Centennial	13
Con. Mercur	.07
Copper Range	61
Daly-West	5⅛
East Butte	13⅜
Franklin	12⅜
Granby	37
Hancock	28½
Hedley Gold	15
Helvetia	1¼
Indiana	15⅜
Isle Royale	18½
Keweenaw	2¼
Lake	38½
La Salle	4½
Mass	5½
Michigan	2¼
Mohawk	48
New Arcadian	3½
North Butte	35¼
North Lake	9¾
Ojibway	8¼
Old Dominion	47⅜
Osceola	100
Parrot	13
Quincy	71
Shannon	11⅜
Shattuck-Ariz	19½
Superior	34
Superior & Bost	6¼
Superior & Pitts.	17½
Tamarack	35
Trinity	4½
U. S. Smelting	37¼
U. S. Smelt'g, pf.	48
Utah Apex	2¾
Utah Con	18¼
Victoria	1¾
Winona	8⅛
Wolverine	112
Wyandot	1⅛

BOSTON CURB June 6

Name of Comp.	Last
Ahmeek	170
Bingham Mines	1½
Boston Ely	1⅜
Boswyocolo	.07½
Cactus	.13
Calaveras	1⅜
Champion	‡.01
Chief Cons	1⅛
Corbin	3
Cortez	1⅜
Crown Reserve	3½
First Nat. Cop	1½
Live Oak	20½
Majestic	.61
Mazatan	1½
Nat'l Mine & Ex.	.20
Nevada-Douglas	2½
Oneco	2½
Raven Copper	.29
Rhode Island Coal	2½
San Antonio	‡3½
South Lake	8¼
Tretheway	‡.95
Tuolumne Copper	‡4½
United Zinc, pfd.	‡2
Vulture	5½
Yuma	‡ 02

‡Last quotation.

CHEMICALS, MINERALS, RARE EARTHS, ETC.—CURRENT WHOLESALE PRICES

ABRASIVES—		
Carbons,good drill quality,carat		$50.00@75.00
Carborundum, f.o.b. Niagara Falls, powd.	lb.	.08
Grains	"	.10@.17
Corundum	"	.07@.10
Crushed Steel, f.o.b. Pittsburg	"	.05¾@.06
Emery, in kegs; Turkish flour	"	.01¾@.02
Grains	"	.03½@.04
Naxos flour	"	.01½@.02
Grains	"	.03½@.04
Chester flour	"	.01½@.02
Grains	"	.03½@.04
Peekskill flour, f.o.b. Easton, Pa	"	.01½@.01¾
Grains, in kegs	"	.02¾@.03
Garnet, per quality..sh. ton		25.00@35.00
Pumice Stone,Am.Powd.,100 lb.		1.60@2.00
Italian, powdered..per lb.		.01¾@.01¾
Lump, per quality	"	.03@.30
Rottenstone, ground	"	.02@.04
Lump, per quality	"	.05@.20
Rouge, per quality	"	.05@.30
Steel Emery, f.o.b. Pittsburg	"	.07@.07½
ACIDS—		
Acetic 28%	lb.	.0160@.0175
Boric	"	.07
Hydrofluoric, 30%	"	.02¾@.03½
" 48%	"	.06
" 52%	"	.06½
" 60%	"	.10
Hydrochloric acid, 20° per 100 lb.		1.25@1.50
Nitric acid, 36° to 40°..per lb.		.03⅞@.04½
Sulphuric acid,50°,bulk per ton.		$12 up
60°, 100 lb. in carboys.		.85@1.12½
60°, bulk, ton		16.00@18.00
66°, 100 lb. in carboys.		1.00@1.10
66°, bulk, ton		18.00
Oxalic	per lb.	.07½@.072
ALCOHOL—Grain 95%	gal.	2.52@2.56
Denatured	"	.42
Refined wood, 95@97%	"	.52@.57
ALUM—Lump	100 lb.	$1.75
Ground	"	1.85
Chrome Alum	"	.04½@.05
ALUMINUM—Sulphate,com'l.	lb.	.90@2.00
AMMONIA—24 deg	"	.04½@.05½
" 26 deg.	"	.04¾@.05¾
AMMONIUM—		
Bromide	lb.	.32
Carbonate	"	.08@.08⅜
Muriate grain	"	.05½@.06
Lump	"	.09½@.09¾
Sulphate, 100 lb.	"	3.10@3.15
Sulpho-cyanide com	"	.25
" chem. pure	"	.35
ANTIMONY—needle,powder	lb.	.04½@.04¾
Oxide	"	.08¾@.10
ARSENIC—white	"	.01½@.01⅝
Red, Outside brands	"	.05½@.06½
Saxony	"	.06¼@.06¾
ASPHALTUM—		
Barbadoes	per ton	100.00@170.00
West Indies	"	30.00@60.00
Egyptian	lb.	.30@.40
Gilsonite,Utah ordinary	per ton	36.00@50.00
Trinidad	"	25.00@30.00
California	per ton	22.50@30.00
BARIUM—		
Carb. Lump, 80@90%	lg. ton	26.00@35.00
Precipitated, 96@98%	"	31.00@33.00
Powdered, natural	lb.	.02@.02½
Chloride com'l	ton	33.25@37.00
Nitrate powdered, in casks	lb.	.04¾@.05½
Blanc Fixe, dry, bbl	per lb.	.02¾@.04
BARYTES—		
Am. Ground	sh. ton	12.00@13.00
Floated	"	16.00@17.00
Foreign floated	"	18.50@22.50
BLEACHING POWDER—35% 100 lb.		1.17½@1.40
BLUE VITRIOL—(copper sulphate), carload, per 100 lb.		4.50@4.75
BONE ASH	lb.	.02¾@.04
BORAX, sacks	"	.03½@.04
CALCIUM—Acetate,gray,100 lb.		1.75@1.85
Carbide, ton lots f.o.b. Niagara Falls, N. Y., for Jersey City, N. J.	sh. ton	65.00
Chloride, f.o.b. N. Y	"	11.00@14.10
CEMENT—Slag cement	bbl.	0.75@1.25
Portland, Am. 400 lb	"	1.20@1.30
Foreign	"	2.25@2.90
"Rosendale," 300 lb. (in sacks)	"	.85 .65
CHROME ORE—		
New Caledonia 50% ex. ship N. Y.	per lg. ton	14.00@16.00
Bricks, f.o.b. Fittsburg, per M.		175.00
CLAY, CHINA—Am. common ex-dock, N. Y.	ton	8.00@9.00
Foreign	"	11.50@18.00
COBALT—Oxide	lb.	.80@.85
COPPERAS—Bulk	100 lb.	$0.55
In bbls	"	.65@.85
In bags	"	.60@.80
CRYOLITE (carload)	lb.	.06¼@.07
FELDSPAR—Ground	sh. ton	6.00@14.00
FIRE BRICK—		
American	per M.	30.00@40.00
Imported	"	30.00@45.00
St. Louis	"	16.00
Extra	"	20.00@23.00
Special extra	"	30.00@35900
FIRE CLAY—f.o.b. St. Louis.		
St. Louis, extra quality	per ton	5.00
" ordinary	"	2.50
FLUORSPAR—		
Domestic f.o.b. Pittsburg:		
Lump	ton	8.00@10.00
Ground	"	12.00@14.00
Foreign crude ex. dock	"	8.50
FULLER'S EARTH—Lump,100 lb.		.80@.85
Powdered	"	.80@.85
GRAPHITE—Ceylon.		
Flying dust, finest to best	lb.	.01@.02
Dust	"	.02@.04
Chip	"	.03@.06
Lump	"	.04@.09
Large lump	"	.04@.08
GYPSUM—		
Fertilizer	sh. ton	5.00
Ground	"	4.00@7.00
INFUSORIAL EARTH—		
Ground Am. Best	lb.	.01¾@.02½
German	"	.02½@.02⅝
LEAD—		
Acetate (sugar of) brown	lb.	.07¾@.09½
Nitrate, com'l	"	.07¾@.08⅜
MAGNESITE—Greece.		
Crude (95%)	lg. ton	7.50@8.50
Calcined, powdered	sh. ton	26.00@35.00
Brick, domes, per qual. f.o.b. Pittsburg	M.	160@200
MAGNESIUM—		
Chloride, com'l	100 lb.	.90@1.25
Sulphate (Epsom salt)	100 lb.	.90@1.00
MANGANESE—		
Foreign, crude, powdered:		
70@75% binoxide	lb.	.006@.01
75@85% binoxide	"	.011@.015
85@90% binoxide	"	.01½@.04
90@95% binoxide	"	.06½@.08½
Ore, 80%-85%	sh. ton	12.00@25.00
MARBLE—Flour	sh. ton	9.00@9.50
MINERAL WOOL—		
Slag, ordinary	sh. ton	19.00
Selected	"	25.00
Rock, ordinary	"	32.00
MONAZITE SAND—		
Guar. 97%, with 5% Thorium oxide, normal	lb.	.08 and up
NICKEL—		
Oxide, crude, lb. (77%) for fine metal contained		.40@.45
Sulphate, single	lb.	.10¾@.11
Sulphate, double	"	.05¾@.08
NITRATE OF SODA—		
100 lb. 95% (spot)		2.10
95% (future)		2.10
96% is 2½@7½c. higher per 100 lb.		
OZOKERITE—best	lb.	.12@.16
PAINTS AND COLORS—		
Litharge, Am. powdered	lb.	.05¾@.06
English glassmakers'	"	.08½@.09⅜
Lithophone	"	.03¾@.04
Metallic, brown	sh. ton	16.50@22.00
Red	"	14.00@18.00
Ocher, Am. common	"	10.00@15.00
Best	"	12.00@15.00
Dutch, washed	lb.	.02¾@.03
French, washed	"	.01½@.02
Paris green, pure, bulk	"	.13@.18½
Red lead, American	"	.06½@.07¼
Foreign	"	.08¼@.09
Turpentine, spirits bbl., per gal.		.63@.68½
White lead, Am., dry	lb.	.05½@.06
American, in oil	"	.07¼@.07½
Foreign, in oil	"	.09¼@.09¾
Zinc white, Am. extra dry	"	.05¾@.06½
French proc's, red seal, dry	"	.08¼@.08½
French process, green seal, dry	"	.10¼@.10½
PHOSPHATES—Acid		60@62c. per unit
*Fla., hard rock 77%		5.75@6.00
land pebble 68%		3.75@4.00
†Tenn., 78@80%		5.00@5.50
75%		4.75@5.00
68@72%		4.25@4.50
‡So. Car. land rock 60%		3.50@3.75
*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.		
POTASSIUM—		
Bicarbonate crystal	lb.	$.07½@.08
Powdered or granulated	"	.08@.08¼
Bichromate, Am.	"	.07⅞@.07¾
Scotch	"	.10¼
Bromide	"	.20
Carbonate (80@85%)	"	.03½@.04
Caustic, ordinary	"	.03¾@.05¾
Elect. (90% KOH)	"	.05¾@.05½
Chloride (muriate), 100 lb		1.90
Chlorate, powdered	"	.08¼@.09½
Crystals	"	.08¼@.09¼
Cyanide (98@99%)		
Carloads (30,000 lb.)	"	18c.
5-ton lots		18½c.
Less than 5 tons		.19
Kainite, long ton, bulk, 7.50; bags,		8.50
Permanganate	lb.	.09½@.10½
Prussiate, yellow	"	.13@.13¾
Red	"	.26@.30
Sulphate (basis 90%)	100 lb.	2.18@2.21
PYRITE—		
Domestic, non-arsenical, furnace size,f.o.b. R. R. per unit		.12@.12½
Domestic, non-arsenical, fines, per unit, f.o.b. mines		.11@.11½
Imported, non-arsenical, furnace size, ex-ship, per unit		.13@.13¼
Imported, arsenical, furnace size, ex-ship, per unit		.12½@.12¾
Imported fines,arsenical,ex-ship		.09½@.10
Imported fines, non-arsenical, ex-ship, per unit		.10½@.11

Pyrite prices are per unit of sulphur. A deduction of 25c. per ton is made when ore is delivered in large lumps.

SALT—N. Y. com. fine 280 lb. bbl.		.72@1.13
N. Y. agricultural	sh. ton	3.80@4.50
SALTPETER—Crude	100 lb.	4.00@4.50
Refined, crystals		5.00@5.75
SILICA—		
Ground quartz, ord'ry	lg. ton	7.00@15.00
Silex, ground	"	7.00@15.00
Silex, floated	"	30.00@40.00
Lump quartz	"	5.00@5.50
Glass sand	"	2.75
SILVER—Nitrate, crystals	oz.	.33½@.36¾
SODIUM—Acetate	lb.	.04¼@.05
"Alkali," per 100 lb., 58|48		.90@.95
Bicarb. soda, per 100 lb		1.00@1.30
Soda, caustic, per 100 lb., 78|60		1.70@1.80
Soda, caustic, powdered		.02½@.03
Salt cake, per 100 lb., bulk		.50@.62½
Salt Cake, bbl		.67½@.80
Soda, monohydrate, per lb		1.30@1.75
Bichromate	lb.	.05¾@.05¾
Bromide	"	.20
Chlorate, com'l	"	.08¼@.09½
Cyanide, 120-130% KCN, per 100%		
Carloads (30.000 lb.)	lb.	18c.
5-ton lots	"	18½c.
Less than 5 tons	"	.20
Hyposulphite, Am	"	1.30@1.50
Phosphate	100 lb.	2.10@2.40
Prussiate	"	.08@.08¾
Sal soda, f.o.b. N. Y	"	.60@.75
Foreign, f.o.b. N. Y	"	.80@1.00
Silicate, com'l	"	.65@1.00
Sulphate, com'l (Glauber's salt)	100 lb.	.60@.80
Sulphate, com'l, calcined		.65@.85
STRONTIUM—Nitrate	lb.	.07@.08
SULPHUR—Louisiana (prime) to New York	lg. ton	22.00 up
To Boston, Philadelphia or Baltimore	"	22.50 up
Roll	100 lb.	1.85@2.15
Flour	100 lb.	2.00@2.40
Flowers, sublimed	100 lb.	2.20@2.60
Powdered commercial, bags		1.55
Sicilian, extra qual., unmixed seconds, crude brimstone to New York	lg. ton	$22.00
TERRA ALBA—Fr.&Eng.	100 lb.	.75@.80
TALC—Domestic	sh. ton	8.00@20.00
French	"	15.00@25.00
Austrian	"	33.00
Italian, best	"	35.00
TIN—Bi-chloride, 50°	lb.	.13¼
Crystals	"	.29
Oxide, lb	"	.45
URANIUM—Oxide	"	2.20@4.25
ZINC—Chloride sol., com. 20	lb.	.02½
Chloride, granular	"	.04@.04½
Dust	"	.06¾@.07
Sulphate	"	.02@.02½

NOTE.—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the saces of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their output on private contract.